

TOWARDS HARMONIOUS EXPERIENCES

A service design approach to evaluating and
optimizing multi-touchpoint user experience

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**Towards harmonious experiences –
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optimizing multi-touchpoint user experience**

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FOREWORD

I would like to first thank my advisor Virpi Roto at Aalto University for your infallible academic guidance, encouraging words, and unshakable patience.

A big thank you to my ABB supervisor Marjukka Mäkelä, and the whole Industrial and User Experience design team for the opportunity, trust, and insight.

My dear colleagues at Leadin,

My dear friends, near and far,

My family,

I would not be here without you. Thank you.

ABSTRACT

Like many other traditionally product-centric companies, ABB is facing the challenges and opportunities of digitalization. ABB's contemporary strategy relies more and more on offering digital services alongside their technically advanced products to their customers. Providing consistent experiences has, therefore, become an increasingly important differentiator factor also in the B2B market.

Over the years, the ABB Drives business unit has developed its offering of software tools that answer to the ever-evolving technical needs of ABB's industrial customers, partners, and employees. In the past, the technology-oriented and expert-driven R&D culture has guided the development of these tools, and the emphasis has remained on solving highly specific technical challenges. While successful in meeting these needs, the experience of end-users, as well as alignment with the ABB brand, have remained secondary priorities. As a result, the offering has become inconsistent in terms of logic, look and feel. The recently renewed ABB corporate brand and the ABB UI style guide aim to bring all ABB digital product user interfaces under the same brand visually, and thus 'harmonize' the software tool offering as a whole. However, it is stated that improving visual aspects of user interfaces alone does not optimize their user experience and that a more strategic, user-centric approach is needed to create more consistent and holistic user experiences.

This thesis documents a case study of how user-centric, service design-based research methods can be utilized to evaluate the user experience of work-related journeys that require interaction with multiple digital systems. The case focuses on ABB field engineers as the users, four case software tools, and drive start-up, registration and start-up reporting in different industrial environments as the case journey.

The theoretical background and the definition of user experience position this study in between user experience design and service design. Moreover, due to the multi-touchpoint nature of this study, the thesis connects with the field of multi-touchpoint experience design, a largely unexplored research field. The literature review indicates that there is a lack of user experience evaluation methods suitable for studying multi-touchpoint user experience of user journeys that include user interaction with multiple separate digital systems over time.

The case study was carried out in three parts: first, to map and quantify the current state and extent of the software tool offering; second, to understand the drive start-up-registration-reporting –journey and to identify the related user experience related aspects; and third, using a co-constructive "UX timeline" method, to evaluate the journey-specific multi-touchpoint user experience of end-users.

Based on the findings of the study, it was found that there are several user experience related points of improvement that affect the user experience. The found issues are predominantly related to work efficiency, user transition between work phases, software tool synergy, and the physical context the tools are used in.

Based on these case results, a contextual definition of user experience is defined, and a user-centric approach is recommended for the Drives business unit to define and prioritize needs for future development of their software tool offering. Therefore, the results of this study are important for the organization on its quest to develop a more strategic and user-centric culture that strives for more holistic and consistent user experiences.

The recommended approach is not restricted or limited to ABB Drives software tool offering and can be replicated to be utilized by organizations that seek to improve the user experience of offerings that consist of multiple interdependent systems used by several user profiles.

KEYWORDS:

User experience, Service design, Industrial services, Multi-touchpoint experience design, Experience evaluation, User journey mapping, Business-to-business, Software tool offering, User-centric design

ABSTRAKTI

Kuten muut alkujaan tuotekeskeiset yritykset, myös ABB on kohdannut digitalisaation tuomat haasteet ja mahdollisuudet. Yrityksen strategia perustuu nykyään yhä vahvemmin digitaalisten palveluiden tarjoamiseen teknologisesti edistyskellisten tuotteiden rinnalla teollisuusasiakkaille. Yhdenmukaisten kokemusten tuomista on siten tullut yhä tärkeämpi erottuvuustekijä myös B2B-ympäristössä.

Vuosien varrella ABB Drives –liiketoimintayksikkö on kehittänyt ohjelmistotyökaluja vastatakseen asiakkaidensa, kumppaneidensa ja työntekijöidensä alati kehittyviin teknisiin tarpeisiin. ABB:n teknologiaorientoitunut ja asiantuntijavetoinen tuotekehityskulttuuri on ohjannut kehitystä, ja siten myös työkalujen suunnittelua. Kyseiset työkalut vastaavat haasteisiin teknisestä näkökulmasta, mutta sekä työkalujen loppukäyttäjien kokemus, että ABB:n brändin noudattaminen ovat jääneet taka-alalle kehityksessä. Ohjelmistotyökalujen tarjoomasta on siten tullut epäyhtenäinen työkalujen toimintalogiikan, ulkonäön ja tuntuman osalta. ABB:n vastikään uudistettu brändi yhdessä ABB:n käyttöliittymien suunnitteluohjeiston kanssa pyrkivät tuomaan kaikki ABB:n digitaaliset tuotteet saman emobrändin alle, yhtenäistämään käyttöliittymien visuaalista ulkoasua, ja siten 'harmonisoimaan' työkalutarjoomaa kokonaisuutena. On esitetty, että käyttöliittymien visuaalinen yhtenäisyys ei yksin riitä optimoimaan käyttäjäkokemusta, ja että yhdenmukaisten ja holististen käyttäjäkokemusten luomiseen tarvitaan strategisempi ja käyttäjäkeskeimpi tulokulma.

Tämä opinnäytetyö dokumentoi tapaustutkimuksen, jossa käyttäjäkeskeisiä palvelumuotoilun tutkimusmenetelmiä on käytetty käyttäjäkokemuksen arviointiin työympäristössä, jossa käyttäjän polku vaatii vuorovaikutamista useamman digitaalisen ohjelman kanssa. Tapaus keskittyy ABB:n kenttäinsinööreihin ohjelmistotyökalujen loppukäyttäjinä, neljään ohjelmistotyökaluun, ja käyttäjän polkuun, joka koostuu taajuusmuuttajien käyttöönotosta, rekisteröinnistä ja käyttöönottoraportoinnista erilaisissa teollisuudelle ominaisissa työskentely-ympäristöissä.

Teoreettinen tausta ja käyttäjäkokemuksen määrittely positioivat tutkimuksen käyttäjäkokemussuunnittelun (user experience design) ja palvelumuotoilun (service design) välimaastoon. Lisäksi, johtuen työn monikosketuspisteisestä luonteesta, työ liittyy uuteen, vielä laajalti tutkimattomaan alaan, monikosketuspistekokemussuunnitteluun (multi-touchpoint experience design).

Työn kirjallisuuskatsaus osoittaa, että on olemassa selvä puute käyttäjäkokemuksen arviointityökaluista, jotka soveltuvat monikosketuspisteisten käyttäjäpolkujen arviointiin ympäristöissä, jotka edellyttävät käyttäjää vuorovaikuttamaan usean erillisen ohjelmiston välillä, pidemmän ajanjakson aikana.

Tapaustutkimus koostuu kolmesta osasta: ensimmäisessä osassa ohjelmistotyökalujen tarjooman nykytila ja laajuus on kartoitettu. Toisessa osassa taajuusmuuttajien käyttöönotto-rekisteröinti-raportointi –polkuun liittyvät kontekstisidonnaiset käyttäjäkokemushaasteet, tarpeet ja ehdotukset on kartoitettu. Kolmas osio keskittyy arvioimaan käyttäjän polkuun sidonnaista loppukäyttäjien monikosketuspistekäyttäjäkokemusta käyttäen yhteis-rakentamiseen (co-constructive) perustuvaa "UX timeline"-tutkimusmetodia.

Tutkimuksessa on tunnistettu useita käyttäjäkokemukseen liitännäisiä epäkohtia. Löydetyt epäkohdat ovat enimmäkseen liitännäisiä työtehokkuuteen, käyttäjän siirtymiseen työvaiheiden välillä, ohjelmistotyökalujen väliseen synergiaan, sekä fyysiseen työympäristöön, jossa ohjelmistotyökaluja käytetään.

Tuloksiin nojaten kontekstisidonnainen käyttäjäkokemus on määritelty, sekä liiketoimintayksikölle on suositeltu käyttäjäkeskeistä lähestymistapaa ohjelmistotyökalujen kehitykseen tulevaisuudessa, hyödyttäen organisaatiota sen kehityspyrkimyksissä kohti strategisesti käyttäjäkeskeisempää kulttuuria, joka tähtää kokonaisvaltaisempiin ja yhdenmukaisempiin käyttäjäkokemuksiin.

Suosittelun lähestymistapa ei ole rajoittunut ainoastaan ABB Drives -liiketoimintayksikön ohjelmistotyökalujen tarjoamaan, vaan se voidaan replikoida ja hyödyntää organisaatioissa, jotka pyrkivät edistämään monisyisten, useita yksittäisiä ohjelmistoja ja niiden erilaisia käyttäjäprofileja sisältävien tarjoomien käyttäjäkokemusta.

AVAINSANAT:

Käyttäjäkokemus, palvelumuotoilu, teolliset palvelut, monikosketuspisteinen kokemussuunnittelu, kokemuserviointi, käyttäjäpolkukartoitus, B2B-markkinointi, ohjelmistotyökalujen tarjoama, käyttäjäkeskeinen suunnittelu

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INTRODUCTION

Delivering excellent products or services is no longer enough as both consumers and businesses alike have become accustomed to demanding better experiences. Even the most technically advanced product does not succeed in the market if the company has overlooked the people who buy and use the product in the end: after all, businesses are run by people, and for people. Today, companies need to pay attention to both pragmatic and hedonic aspects of their offering in order to deliver experiences that make the company stand out, engage and commit.

Experiences are holistic, and as complex as we humans are. Experiences are what make a company feel personal, caring and worthwhile to its customers and end-users. People experience companies as entities – not as individual products, projects, services, or organizational silos like they are often seen from the inside. For people, companies are solid and seamless: they are perceived – and judged – as whole entities. It is not possible to design experiences per se – they can only be designed for (Sanders 1999). Therefore, to design for experiences, understanding the people is key.

ABB IN THE FACE OF DIGITALIZATION – CALL FOR CONSISTENT EXPERIENCES

Like any other large company, ABB, too, is facing the challenge and the opportunity of digitalization: once a product-centric business in which customers' needs were met with technical products, ABB's contemporary strategy relies increasingly more on services offered beside them. The B2B market has followed the lead of B2C in terms of its orientation to services: holistic and seamless offerings will be taken for granted. Thus, an increasing amount of attention is needed to be directed towards delivering consistent experiences. At ABB, due to the recent evolvement of business dynamics and digitalization have surfaced a need for better experiences, and traditional methods of product and service development are no lon-

ger viable when competing in the global market. Providing better experiences has become an undeniably important factor for the organization to differentiate the company from its competitors. The situation calls for a holistic approach that takes products, services, and people into account. (ABB 2016, Mäkelä 2017)

From an organizational point of view, being able to deliver consistent and successful experiences has various benefits that extend beyond the end-user's experience. Rawson et. al. (2011) argue that skillful management of entire end-to-end experiences can lead to enhanced customer satisfaction, increased revenue, greater employee satisfaction, and reduced churn. Sundberg (2015) proposes that providing better experiences to users and customers may lead to more satisfied and loyal customers, as well as more long-term relationships. Indeed, she concludes that the design and delivery of positive user experience are to be considered valuable for all three stakeholders: the user, the provider, and the customer (Sundberg 2015).

INTRODUCING THE CLIENT, ABB DRIVES

ABB Group and ABB Drives

ABB (www.abb.com) is a globally recognized conglomerate in power and automation technologies that enable utility, industry, transport and infrastructure customers to improve performance while lowering environmental impact (ABB 2015). The ABB Group operates in approximately 100 countries and employs close to 140,000 people. Being one of the largest conglomerates in the world, the company focuses on engineering, process efficiency, and manufacturing of heavy machinery and automation for industrial customers. (ABB 2017).

The client of this study, ABB Drives, is one of ABB Group's several business units. ABB Drives has 6,000 employees and it is responsible for designing, manufacturing, and selling of all ABB frequency converters to a wide range of customers. It has several R&D and manufacturing sites in Europe, Asia, and the US, one focal location being in Helsinki, Finland.

The Industrial and User Experience design team as advocate of user-centricity

ABB Drives' product development culture has originally been expert-driven, relying on the design engineers' expertise, technical knowledge, and engineering. At ABB Drives, user-centricity is a relatively new approach to design and development, and the business unit is now taking steps to balance its traditional ways of working with user-centricity, led by the in-house Industrial design and User experience team. The ambition of this team is to integrate user-centered design and design thinking into ABB Drives' new product development culture by working as ambassadors of user-centric design. The team provides and develops design operations in design disciplines of Product design, User interface design, and Service design through user studies, concept designs, prototyp-

ing, visualizations, usability testing and facilitation. The overarching theme is to create awareness of both customer (CX) and user experience (UX) design, and thus calling it as "CUX" design in the organization. The team's design operations focus on meaningful functionality, ease of installation and use, as well as efficient maintenance. The team has put together numerous user-centric design projects and programs, as well as a throughout and comprehensive online database of design tools and methods that are at everyone's disposal in the organization. (Mäkelä 2017)

A 2014 internal analysis conducted by the Drives Industrial and User experience team uncovered that the sales people are the ones in immediate contact with the customer; yet they are not the ones who are expected to bring customer knowledge into the ongoing R&D projects: product managers should be the ones who have the responsibility to know and communicate the customers' needs to R&D. R&D engineers therefore ordinarily rely on second-hand information about customers and end-users – as an example, there are R&D engineers for who have never visited a customer site, let alone met any end-users. All this can result in that customer and user knowledge is not sufficient, and information may be filtered, biased or even lost completely in the process. (Mäkelä 2017)

"We still face a great challenge in making our organization see the value of design beyond simply enhancing product appearance. We are taking steps towards balancing our traditional way of working with a user-centric approach. The important message for everyone in our organization is to understand that every individual can deliver and contribute to this topic in their everyday work." (Mäkelä 2017)

DRIVES ARE FREQUENCY CONVERTERS FOR ELECTRIC MOTORS

Drives, also called frequency converters, are used in almost any industry and application. For electric motors to provide the intended torque and speed, they require a corresponding amount of energy. Drives continuously calculate and adjust the frequency and voltage, dispensing only the needed amount of energy delivered to the motors, thus optimizing the process energy efficiency. Drives do so by converting fixed frequency alternative current (AC) power into variable frequency, variable voltage AC power that precisely matches the process requirements. (ABB 2017)

ABB Drives offers a vast variety of drives along with services for industrial customers that require low-power, medium voltage, direct current and high-power drives for their industrial processes. The life cycle of drives is dependent on the industrial application, typically ranging from 20 to 40 years in use from start-up to end of life. (ABB 2016)



Picture 1: New generation ACS880 drives used for educational purposes

ABB DRIVES SOFTWARE TOOLS AND SOFTWARE TOOL OFFERING

In this study, software tools are defined as digital user interfaces actively offered and/or used by ABB Drives business unit.

Along the years, individual product groups and teams across ABB Drives have designed and developed a variety of highly specialized software tools to meet the specific needs of their industrial customers. Majority of these software tools are intended for configuration, optimization and operation of ABB Drives products and hardware (i.e. low, medium and high power drives, and related applications) (Figure 1). Naturally, the use cases of these tools vary significantly by drive product family and intended industrial application. However, not all of these software tools are directly linked to drives products, and thus the software tools relevant to this study are distributed along the whole drive life cycle, starting from 'awareness' and ending to 'end of life' (Figure 2). Most of the tools are accessible by customers or their representatives, yet some are for ABB internal use only and used by ABB employees and/or partner representatives.

It is important to note that like any tools, software tools do not deliver the service alone. Hence this, tools are to be seen as enablers that make it possible for the user to complete a specific goal or work task part of a particular service. For example, in the case of drive start-up as a service, successful start-up is the service that may be delivered by an individual person. In this case, different parts of the service are completed using different software, depending on the needs of the user and the benefactor. Like with any tool, this choice is made based on their suitability for the task.

Despite the fact that the majority of the tools considered part of the offering have been developed to serve a highly specific technical purpose, some tools match the needs of a more heterogeneous

user group and/or a longer proportion of the drive life cycle. As an example, the main purpose of one mobile tool is mainly offered to enable quick drive registration, whereas another tool is a multi-purpose suite that combines the tools required for configuration, programming, debugging and maintenance of automation projects.

Majority of the tools considered part of the software tool offering are Windows PC applications, yet there are numerous web-based applications, as well as a few smartphone applications for Android and iOS mobile operating systems.

In this study, the terms '*software tool offering*' or '*offering*' for short, refer to the collection of all software tools ABB Drives offers to its employees, customers, partners, and/or their end-users along the drive life cycle. In this study, these terms are used as they are the generally used and understood terms inside the organization.

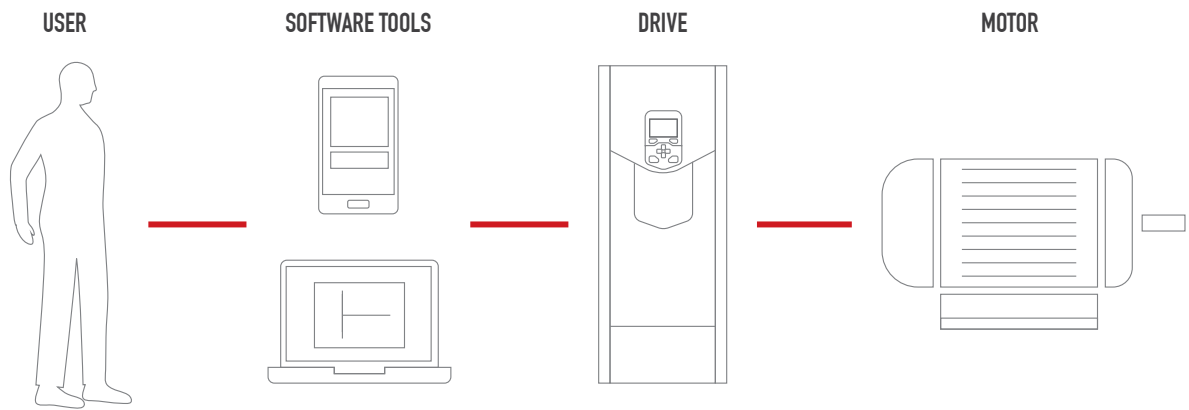


Figure 1: Software tools are typically used to configure, optimize and operate drives

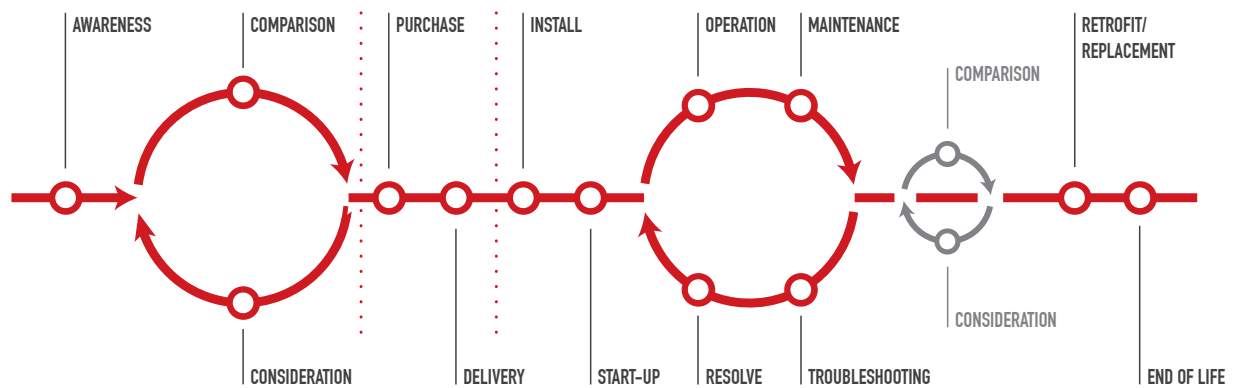


Figure 2: ABB drive life cycle (ABB 2016)

The software tool offering *includes* tools that are:

- » Developed, owned and maintained by ABB Drives business unit and/or product groups within
- » Paid or free-to-use Windows PC applications, plugins, web-based platforms, or smartphone applications
- » Either standalone tools or add-ons that have a specific purpose of use
- » currently offered to customer through ABB website, and/or through ABB sales globally or locally, or as well as on Google Play and iTunes.

The offering *excludes* tools that:

- » Are owned by other ABB business units, as well as tools that are owned on ABB global level (Group owned)
- » Are ABB branded software products that are owned by third parties
- » Have no specific user interface to interact with (for example databases)
- » Have become obsolete or are on the verge of becoming obsolete

THESIS STRUCTURE

This study was conducted utilizing a variety of service design methods throughout the different research stages.

The first part of the study focuses on quantifying data about the complex nature of the software tool offering and concretizing the research data with visualizations and subsequently setting the case tools, user, and journey. The second, qualitative design research part of the study is about understanding the case tools used in the drive start-up procedure by observing drive start-up simulations and identifying the aspects that affect the participants' user experience. The third part focuses on evaluating the multi-touchpoint experience of three participants utilizing 'UX timeline', a co-creative research method. The fourth part of the study focuses on research conclusion, discussion and self-reflection. The fifth and last chapter introduces a conceptual user-centric approach to optimizing multi-touchpoint user experiences.

Experiences are holistic and as complex as we humans are. Experiences are what make a company feel personal, caring and worthwhile to its customers and end-users.

People experience companies as entities – not as individual products, projects, services, or organizational silos like they are often seen from the inside.

SCOPE OF THE THESIS

RESEARCH QUESTION

The aim of this study is to identify those aspects that affect user experience additional to visual consistency, and could make the Drives software tools offering more consistent and thus improve the user experience. The results of this study are expected to support the design and development of new and existing Drives software tools in compliance with the UI style guide and the organizations' quest for a unified UX strategy.

- » How can a user-centric approach help in harmonizing a large software tool offering?
- » What is "good user experience" in this context?
- » What is consistency and how is it relevant to user experience?
- » What are the benefits and risks of introducing consistency to a large digital product offering?

RESEARCH OBJECTIVES

The objectives of the study are (in order of completion):

1. Map the extent of the current software tool offering and visualize it (first design deliverable).
2. Identify the aspects that affect user experience of a case journey of an end-user profile
3. Based on the study results, make recommendations on how to proceed to harmonize the software tool offering from consistent user experience standpoint (second design deliverable – partially undisclosed)

EXPECTED BENEFITS OF THE STUDY

(Client) Business unit-wide understanding of the current state of the software tool offering

- » Supports information sharing, discussion and decision making across product groups within the Drives business unit
- » Helps identify gaps and overlaps in the current offering

(Client) Steps toward a strategic, harmonized user experience

- » Helps in developing a more user and context-aware perspective for new product development
- » Helps in disseminating the importance of user-centricity and user experience

(Academic)

- » A practical application of "multi-touchpoint experience design" (Roto et. al. 2016)
- » UX evaluation method for task-specific multi-touchpoint environments

METHODS

This study was carried out using quantitative, qualitative and co-constructive research methods in different phases of the research. The used methods are described in more detail in each section of the study. Research methods used in this study are listed below:

Literature review: what is UX in the context of this study?

- » HCI, marketing and service design approaches to human-centric design
- » User experience (UX) & customer experience (CX)
- » Touchpoints, channels and user journey
- » Multi-touchpoint experience design

Mapping the current state of software tool offering

- » Quantitative data
- » Mapping the software tool offering
- » Data visualizations

Inspecting the multi-touchpoint user experience

- » Observation
- » Simulation
- » Semi-structured expert interviews
- » 'UX timeline', a co-constructive research method

THE CHALLENGE

THE CORPORATE BRAND RENEWED

Together with the new ABB Digital strategy (launched in October 2016), ABB Group started adopting a single ABB corporate mother brand to include all of its numerous brands under the same umbrella. The transition is expected to take up to two years to be fully implemented. According to the 2016 press release, unifying the brand plays a key part in realizing value of ABB's digital offering. The brand is expected to increase customer loyalty, price premiums and profitability of purchase (ABB 2016). In the release, the brand is described as follows: "The brand will feature design elements intended to clearly articulate ABB's vision, direction and unique market position to customers, shareholders, employees and all other stakeholders. ABB's heritage as a pioneering technology leader and the three focus areas of its Next Level strategy are reflected in its new brand promise: "Let's write the future. Together."" (ABB 2016)

ABB COMMON UX INITIATIVE & ABB UI STYLE GUIDE

During the time of this study, an internal ABB group level initiative 'Common UX' released the first official and company-wide UI style guide. The ABB Common UI style guide is intended to be used in the design process of new software products in order to harmonize the visual look and feel of all software sold to customers in all ABB business divisions. The UI style guide lays the foundation for unified user experience by focusing on visual guidelines, interaction pattern reuse, as well as specifying the nomenclature of ABB software products.

The first version of the ABB common UI style guide (called 2.0 revision) was released for internal use in late 2016. The next release will be available in late April 2017 including newly released revised branding elements. Hence this, all references to the ABB Common UI style guide in this study are based on the 2.0 revision (ABB 2016). The specific contents of the UI style guide remain undisclosed for confidentiality reasons.

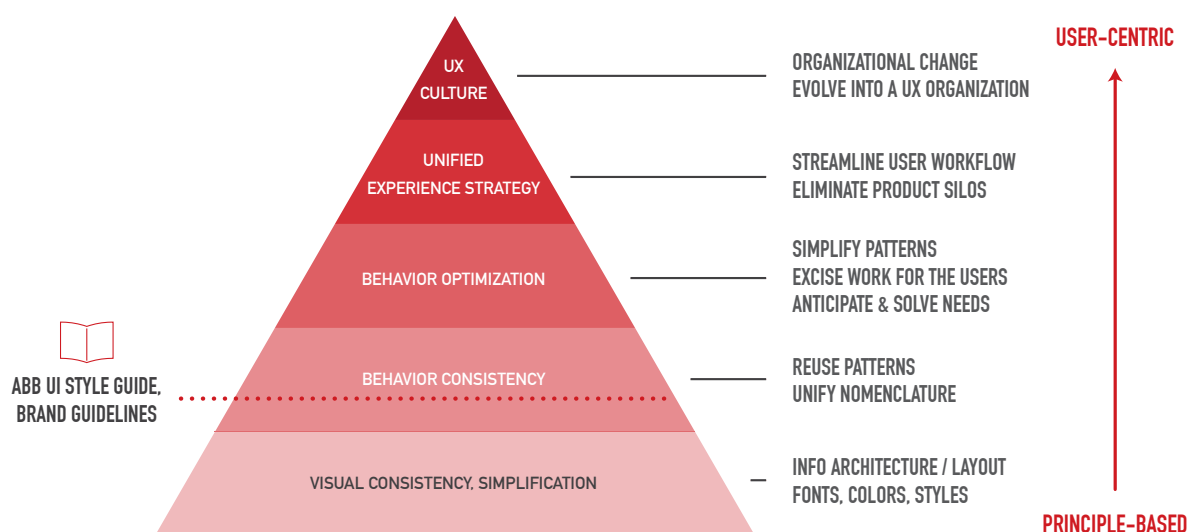


Figure 3: ABB UI style guide and corporate brand guidelines reach the second level of Kloeck's model, 'the hierarchy of effort to fix a broken user experience' (2012).

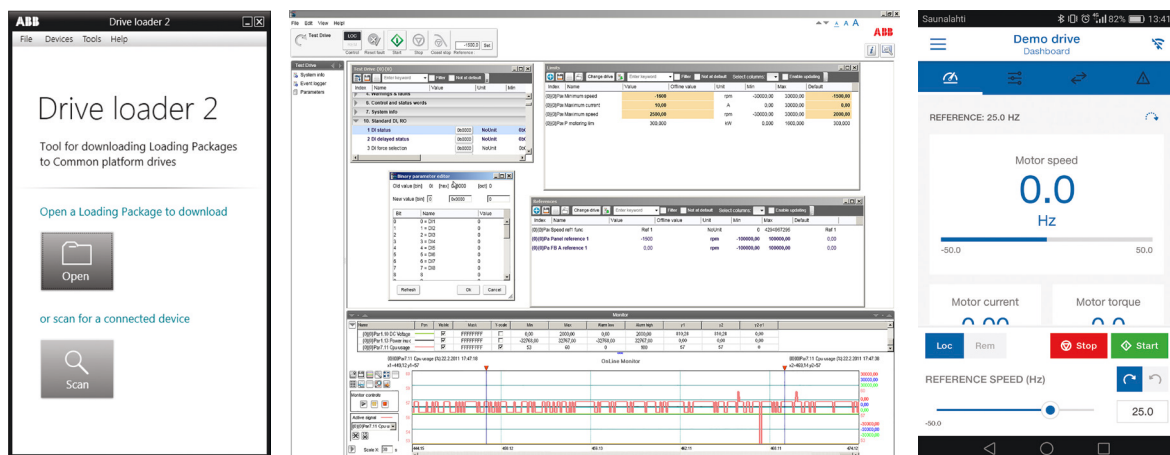
The hierarchy of effort to fix a broken user experience

The ABB UI style guide refers to Kloczek's model *the hierarchy of effort to fix a broken user experience* (2012) (Figure 3). The model describes the approach of improving user experiences in companies that have a large offering of digital services. The approach is based on the idea that the bottom level, visual consistency, is the lowest level of consistent experiences, and thus easiest to achieve. Moving upwards, the more user-centric the company becomes and more important the elements are for providing consistent experiences, and the more the changes are related to organizational changes and require effort.

Laying the foundation for the UX initiative, the first released version of the ABB Common UI style guide refers to the model. The UI style guide focuses on the two bottom levels of the pyramid: Visual consistency & Simplification, and Behavior consistency. The model is therefore used as a framework and reference throughout this study to provide a common language.

INCONSISTENCIES AMONG THE SOFTWARE TOOLS

Drives-owned software tools have traditionally originated from individual project teams under parallel product groups within the business unit, often developed by individual R&D project teams inside the business unit, with or without input from third parties. In these teams, a major part of the work effort has gone to development work that focuses on resolving the assigned technical challenges. As the tools have been developed with a technology-centric approach, focus on the end-users, as well as alignment with the ABB brand, have often remained secondary priorities. Moreover, the tools are maintained and developed at a different pace in the organization due to reasons such as internal responsibility areas, customer base, and potential return on investment. Additionally, as the tools have often been developed in separate project teams, the tools are often seen as individual entities, rather than components part of a larger offering. Due to these reasons, the tools lack consistency in logic, look and feel.



Picture 2: Example of ABB Drives software tools with visually inconsistent user interfaces (ABB 2015, 2017)

Newer generation drives, from 2010 onwards, are based on the 'all-compatible' idea: all new ABB drives share the same software platform as well as the common software tools, control panels, field-buses and other options (ABB 2017). This means that gradually, the users of different drive products will start to use the same exact software tools. This means that drive-specific software tools will no longer be created, making the software tool offering more consistent and compact in the future.

Today, the most apparent inconsistencies between the software tools are visual – some of the tools seem visibly older than others, whereas some tools have been developed for contemporary platforms and screens, and therefore have a more contemporary user interfaces.

Most of these visual inconsistencies can be successfully addressed by implementing the ABB Common UI style guide. Followed rigorously, the UI style guide has the potential to bring the tools visually closer to each other and improve their usability, aesthetics, as well as alignment with the ABB brand. At the moment, however, the guidelines only provide assistance for improving *visual* consistency and interaction patterns of user interfaces. Hence, the guidelines are sufficient to reach only the second level of the pyramid.

It is also believed that some tools may serve similar use cases or user needs, and that technical overlap between the tools, their use cases, and their features may exist. However, identifying the overlap of technical features is not within the scope of this study, as such work would require in-depth technical knowledge and expertise about each tool and their functionality. However, by painting a larger picture of the offering, the results of this study will guide the organization to focus on certain areas in the offering where these overlaps potentially occur. Hence, the results of this study provide grounds for future research on the topic in the organization.

UX CHALLENGES BEHIND VISUAL INCONSISTENCY

This study focuses on identifying those UX factors that lie behind and between individual software tools in order for the organization to develop and optimize the end-user's journeys.

In the case of ABB Drives, the user typically interacts with a number of software tools across platforms and channels to complete a specific task. Given the way the tools have been developed, the tools may not fully address or meet the context they are used by the users in the field. Challenges on this level deal with the user's workflow, work efficiency, work quality, and even safety. Therefore, focusing on identifying and solving challenges on this level is expected to have a larger impact on the overall user experience (Figure 3). To evaluate how well the software tools support their users' workflow, individual software tools are not perceived as isolated systems, but as touchpoints a user's end-to-end journey of a particular work task consists of.

Klocek (2012) describes focusing on these UX aspects 'behavior optimization', including evaluating user needs and goals, aiming for eliminating user's work and simplifying work patterns. The fourth level of the pyramid, 'unified experience strategy', looks at experiences more holistically, and requires re-evaluation of the organization itself – product silos, and considering the ideal workflows for individual users.

In order for ABB Drives to harmonize the software tool offering as a whole, identifying any underlying challenges, as well as their effect on the overall user experience, is crucial. Therefore, referring to Klocek's model (2012), the main focus of this study is on the third and fourth level of the hierarchy pyramid; behavior optimization and unified experience strategy (Figure 4).

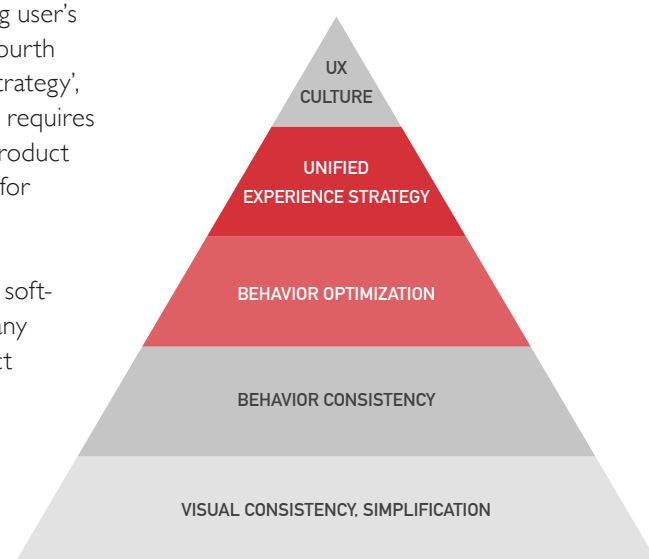


Figure 4: The focus of this study. Based on Klocek (2012).



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THEORETICAL BACKGROUND

As user experiences are always subjective and tied to a context, focusing on utilizing user-centric research methods was necessary for this study. Moreover, as end-users interact with an offering, the end-user's perception of the ABB brand was to be taken into account. To form a holistic enough approach to user experience, three alternative approaches to experiences were looked into: human-computer interaction, marketing, and service design.

THE CONCEPT OF USER EXPERIENCE

Hassenzahl (2014) states that an experience is a complex fabric of feelings, thoughts, and actions. Roto et al. (2011, p. 4) state that the verb 'experiencing' refers to *"an individual's stream of perceptions, interpretations of those perceptions, and resulting emotions during an encounter with a system."* Therefore, when dealing with experiences, the focus remains on the user's subjective experience that occurs when they use or interact with a product, service, or system. Given this, each person's experience can be different – experiences themselves cannot be designed: they can only be designed for. (Sanders 1999, Kaasinen et al. 2015) However, it has been argued that understanding how products are used in the work context and by eliminating those aspects that evoke negative feelings – such as frustration – it is possible to strive towards positive user experiences (Sundberg 2015). To do so, experiences are to be carefully considered on all levels. For example: in a car, the feeling of seats, the sound of the engine, the smell of the interior and the look of the body are all aspects that reinforce one another, forming the experience of the car. (Brown 2009)

There are dozens of definitions for user experience (UX). User experience design is argued to cover the pragmatic, hedonic, and emotional aspects of the use of a product, service, or system (Sundberg 2015). In attempt to clarify user experience as a concept, the authors of UX White Paper

(Roto et. al. 2011) argue that UX is often used as a synonym for usability, user interface design, interaction design, customer experience or web design – or as an umbrella term covering all of these. From one perspective, Roto et. al. (2012) define UX at work as "the way a person feels about using a product, service, or system in a work context, and how this shapes the image of oneself as a professional." The international standard on ergonomics of human system interaction (ISO 9241-210), defines UX as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service".

Customer experience (CX), on the other hand, is the internal, subjective response that customers have to any contact with the company, whether directly or indirectly. Direct contact occurs through purchase, use, and service, whereas indirect contacts involve unplanned encounters with the company brands, products or services. (Meyer & Schwager 2007) Similar to UX, CX is thereby focused on the individual's experience, yet involves a relationship between the individual customer and the company.

HOW CAN UX BE MEASURED?

The ISO 9241-210 criteria for good usability (effectiveness, efficiency, and satisfaction) can be used as starting points for measuring user experience, yet a universally applicable list of qualities for good UX does not exist – this is due to the fact that different products may target entirely different experiences (Kaasinen et. al. 2015). The goals for 'good UX' are therefore to be defined before products can be measured against them.

It should be noted that evaluating user experience differs from usability evaluation: usability focuses on effectiveness and efficiency, whereas user experience evaluating includes more hedonic, emotional and subjective characteristics (Vermeeren et. al. 2010). Due to this, straightforward usability tests

are not adequate for measuring the experience of use (Sundberg 2015).

There may not be one generally applicable way to measure UX, but measuring can be made possible in various ways (Roto et al. 2011). However, when attempting to do so, it is possible to end up measuring irrelevant or incorrect aspects (Sundberg 2015). Measuring methods vary from predefined metrics to open measuring, in which the user describes their experience in their own way.

Kaye & Taylor (2006) suggest the following guidelines for evaluating UX:

- » In order to understand and appreciate the complexity of lived experience, a detailed and rich description of the situation is needed
- » The situation in which the user interacts with the technology is to be recognized
- » All stakeholders involved need to be identified and their experiences to be evaluated, too
- » The values of the stakeholders need to be understood, as they affect the way the technology is experienced – these values are local, rather than universal
- » The ambiguity of experiences should be embraced rather than eliminated to provide better and richer descriptions

Many researchers argue that focusing on long-term UX can be more relevant than measuring short-term UX, as positive long-term experiences are often the reason to continue usage of a system, as well as the reason to recommend the system to others (Hassenzahl 2014, Kujala et al. 2011). Earlier studies show that evaluations are more accurate in predicting human behavior than daily ratings, as time tends to 'even out' momentary bad experiences, revealing the overall experience (Hassenzahl 2014, Kujala et al 2011).

Research may take place in either laboratory environment or in the field. Although field studies may provide a more realistic context, they can be obtrusive and time-consuming. (Vermeeren et. al. 2010)

SOFTWARE TOOLS AS TOUCHPOINTS ALONG THE USER JOURNEY

Typical to B2B, end-users are rarely customers (Sundberg 2015). In the case of ABB Drives, software tools considered part of the software tool offering have various end-user profiles, including customer representatives, partners, subcontractors, and employees. In this context, an end-user typically interacts with multiple software tools across channels and platforms to perform tasks defined by their work role and relationship with the organization. Consequently, the contents of a user's 'toolbox' is always dependent on the user's work role, relationship with the organization, as well as the given task.

In the context of ABB Drives software tools, for a user to complete a specific work task, users are often required to deal with several software tools that are needed during different work phases for the task to be completed. Hence, the user experience is formed during the time span the task is completed, using multiple tools. Given these circumstances, the overall user experience cannot be evaluated by treating the software tools as separate entities, but rather as touchpoints along the journey the task consists of. This has been noted before by Rawson et. al. (2013) who argue that focusing on maximizing user satisfaction in certain touchpoints possesses a danger, as such perspective does not treat touchpoints as parts of the end-to-end journey. Focusing on individual touchpoints, they state, can divert the focus from the journey itself, that can lead to a distorted picture of the overall user satisfaction (Rawson et. al. 2013). Likewise, Roto et. al. (2015) claim that experience design researchers should pay more attention to all touchpoints.

Jenkinson (2007) sums up the general agreement on the term touchpoint as “a point or moment of contact/ communication between an organization or brand and an individual consumer or stakeholder”. Touchpoints are one of the key aspects of service design, and they form the link between the service provider and the customer. In service design, existing knowledge about touchpoints mainly originates from practice-based consultancy and can be traced back to integrated marketing and customer relationship management (CRM) literature (Clatworthy 2011). Clatworthy (2011) states that from this angle, integrated marketing is close to service design through three characteristics: comprehension of consumer behavior; focusing on the brand, and the link to customer experience (CX).

Koivisto (2009) separates service touchpoints into four separate groups: *channels, objects, processes, and people*. Channels refer to the physical environment, spaces, online or phone services. Objects refer to the physical objects the customer or the service provider interacts with, but are nevertheless visible to the customer. Processes include the ways the services are produced and delivered. People refer the actors that are relevant to the specific journey. (Koivisto 2009)

In a Nielsen Norman Group article “How Channels, Devices, and Touchpoints Impact the Customer Journey”, Flaherty (2016) describes touchpoints: “A touchpoint represents a specific interaction between a customer and an organization. It includes the device being used, the channel used for the interaction, and the specific task being completed. A customer journey is made up by a series of touchpoints, with each touchpoint defining the details of the specific interaction.”

HUMAN-COMPUTER INTERACTION FOCUSES ON POSITIVE EXPERIENCE WHILE USING AN INDIVIDUAL SYSTEM

The field of human-computer interaction (HCI) traditionally focuses on positive user experience while a user interacts with a system (Roto 2016). Literature in the HCI field generally deals with short-term UX that begins from the use of an individual system and ends after using it. Hence this, the methods developed for evaluating and measuring UX most often focus on the user's short-term interaction with a system (Vermeeren et. al. 2010). Many researchers, however, argue that it is more relevant to measure the long-term user experience than experience in different moments (Hassenzahl 2014, Kujala et al 2011).



Figure 5: Touchpoints along a customer journey. Modified from Nielsen Norman Group (2016).

The time spans of UX are described in UX White Paper (Roto et. al. 2011) as *anticipated, momentary, episodic and cumulative UX*: “People can have indirect experience before their first encounter through expectations formed from existing experience of related technologies, brand, advertisements, presentations, demonstrations, or others’ opinions. Similarly, indirect experience extends after usage, for example, through reflection on previous usage, or through changes in people’s appraisals of use.”

Even though the UX time spans address time as a UX factor, the HCI approach still focuses on interaction with a single system or user interface (Figure 6). Thus, the HCI approach does not cover the user’s transition between separate user interfaces required by the scope of this study.

SERVICE DESIGN FOCUSES ON TOUCHPOINTS AND JOURNEY OPTIMIZATION

Human-centric thinking is the core of service design. In service design, both service development and delivery are constructed around the users and their experiences (Miettinen 2017).

According to Miettinen (2017), “the aim of service design is to create customer- or human-centered solutions that make the service experience feel logical, desired, competitive and unique for the user, and boost innovation and engagement in companies and institutions while developing and delivering services.” Service design places the customer in the center to design their journey along service points (i.e. touchpoints) and typically focuses on the smoothness of the journey by optimizing service effectiveness and efficiency to ensure customer satisfaction (Roto, Joutsela, Nuutinen 2016). One of the main

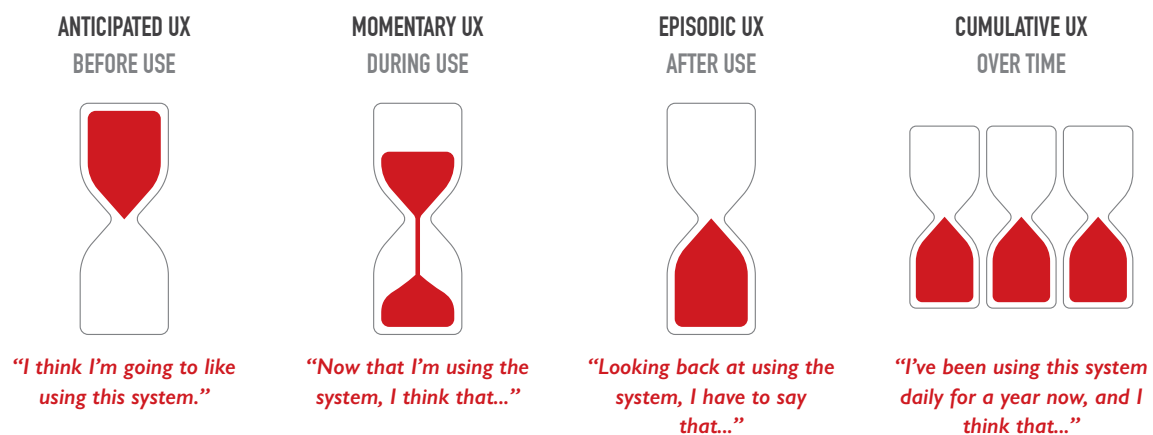


Figure 6: Time spans of UX. Modified from Roto et. al. (2011)

goals of service design is to improve the customer experience (Zomerdjik and Voss 2010). Clatworthy (2011) sums that service design is “*design for experiences that happen over time and across different touch-points*”. Miettinen (2017) also argues, that the aim of service design is to coordinate the multiple channels through which services are delivered: in person, through mobile and digital channels.

Based on these definitions, it can be said that service design is human-centric and focuses on the experiences that form through several touch-points over a time period. Service design therefore addresses the multi-touchpoint and time-related context required by the scope of this study.

MARKETING ADDRESSES THE MULTI-CHANNEL ASPECT

A person's transition from one channel or platform to another is covered in marketing: omnichannel customer experience addresses the whole customer journey, focusing on coordinating the customer's transition across channels, as well as the customer's ability to proceed through the stages of their journey (Nielsen Norman Group 2016). Like service design, omnichannel deals with CX, covering all contact a customer has with the company (Figure 7).

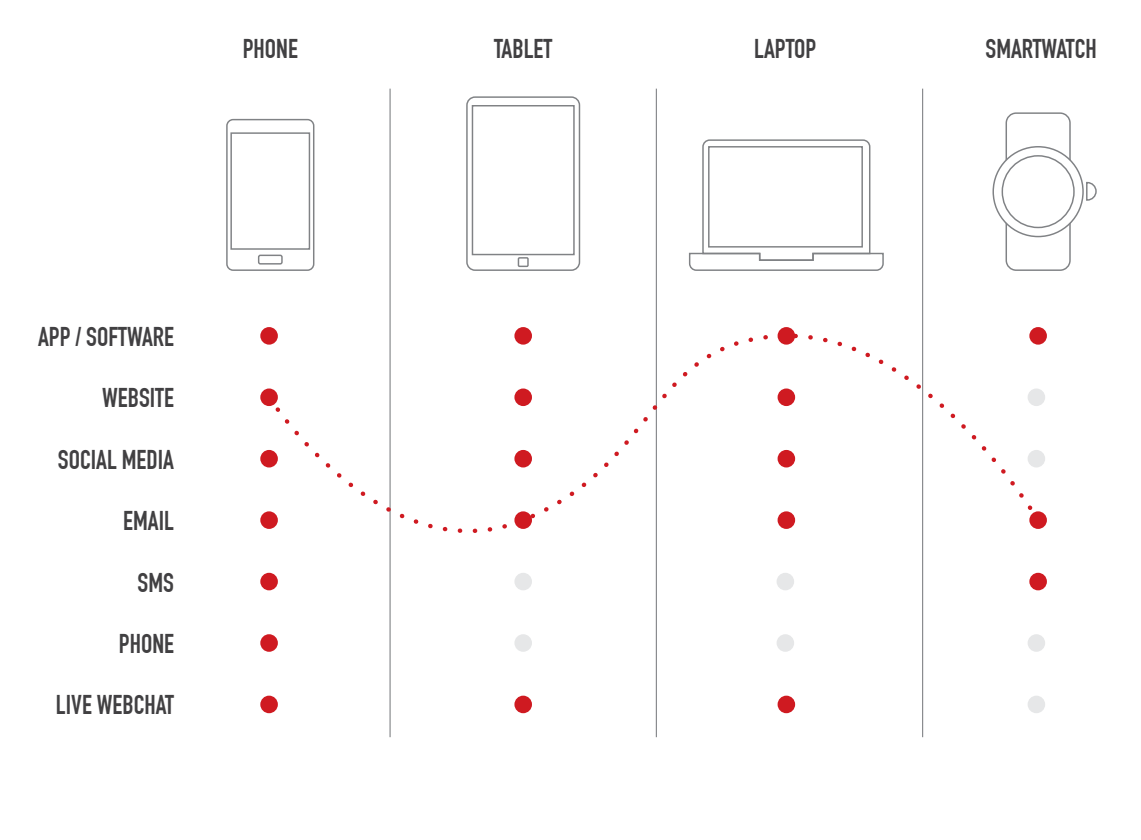


Figure 7: Example of user transition across devices and digital channels. Modified from Nielsen Norman Group (2016)

DEFINITION OF UX IN THE CONTEXT OF THIS STUDY

Although all three aforementioned disciplines' approaches to experiences are human-centric, none of them fit the context of this study perfectly on their own. On one hand, the HCI view on UX is not holistic enough as it only adheres to individual systems, and therefore does not address interaction with *a collection or mix of user interfaces*, even when the time span of UX is broadened to cumulative UX. On the other hand, the omnichannel view in marketing is too broad, as it involves *all* interactions with the organization and the brand, both direct and indirect. Service design's journey- and touchpoint-centric approach fits the context of ABB Drives, yet as in marketing, the focus lays on customer experience (CX), excluding those users who do not hold a customer relationship with the supplier. Thus the term 'customer experience' does not directly fit the context of this study in which the users of tools can represent either ABB's internal users, its partner, or the customer. It should be mentioned, however, that UX and CX are often used interchangeably in literature. To provide a more holistic perspective to user experience, an amalgamation of the three disciplines' approaches to experiences was defined for the use of this study.

In this study, the term UX is defined as follows:

User experience (UX) is the subjective experience that is formed when an end-user, regardless their role and relationship with the organization, interacts with ABB Drives through multiple software tools part of the offering, across intended platforms and channels during the timeframe of completing a specific task or journey.

Basing on service design, this approach to UX removes the key barriers between the disciplines:

- » It enables individual software tools to be evaluated as touchpoints along a journey and time span, rather than as isolated systems
- » It addresses the context in which the user interacts with multiple digital user interfaces, across platforms and multiple channels
- » It focuses on end-users without differentiating them based on their role or relationship with ABB

Moreover, this approach enables a more outside-in perspective, in which the offering is seen from the perspective of individual users who perceive the offering as whole instead of the organizational perspective in which software tools are often treated as separate entities.

The approach of UX aligns with the new design field of multi-touchpoint experience design, coined by Roto et. al. (2016). Multi-touchpoint experience design (MultiXD) as a design field combines the fields of UX design, omnichannel design, and service design (Roto et. al. 2016) (Figure 8). Roto (2016) describes the concept of multi-touchpoint experience design: *"The key idea behind multi-touchpoint experience design is to aim for a harmonious experience across all touchpoints and channels."*

However, being a new field in research, only a few papers have been published about multiXD, and no universally accepted and applicable methods for evaluating experiences have been published to suit the needs of this study.

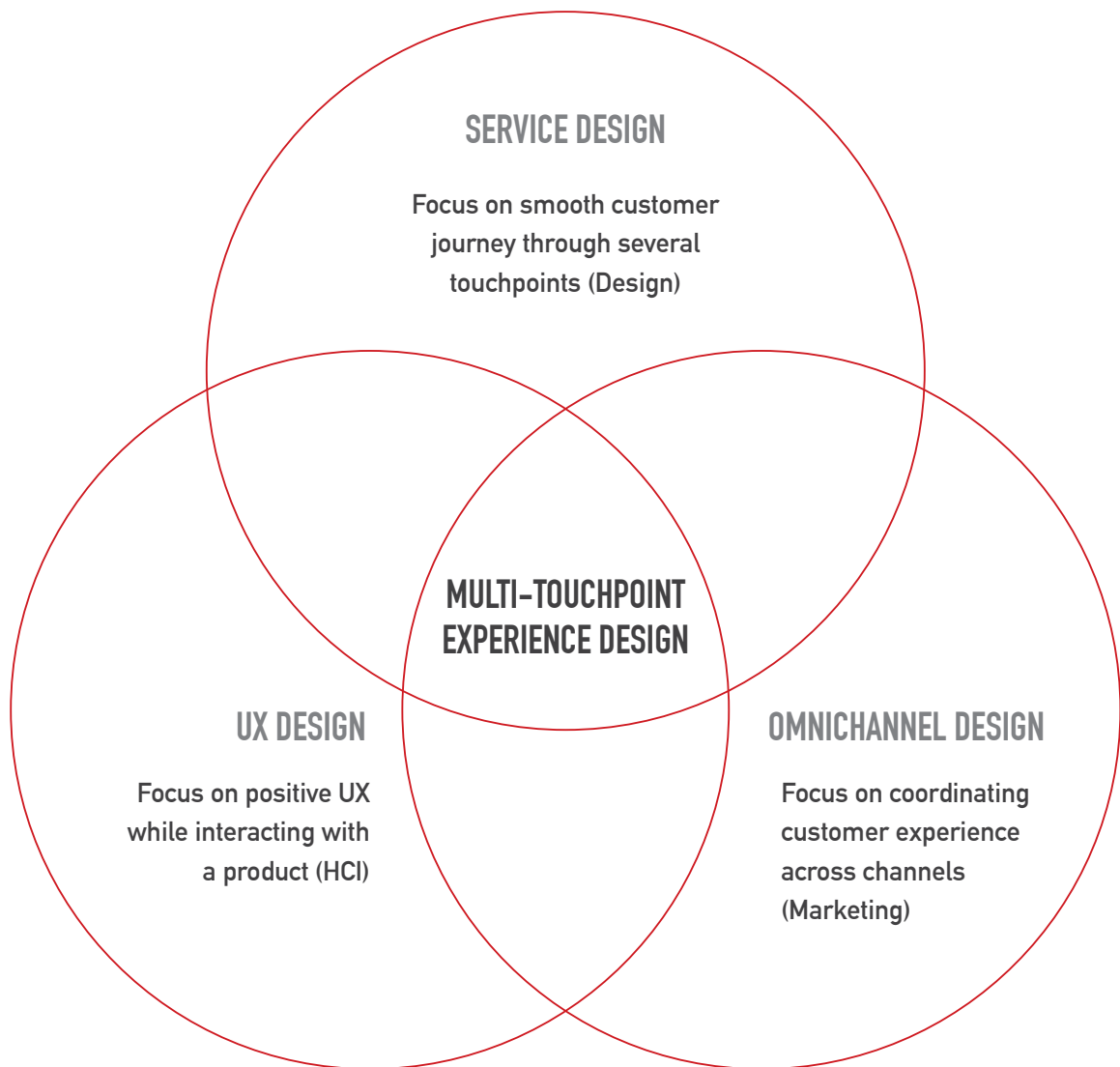


Figure 8: Multi-touchpoint experience design after Roto et. al. (2016)

QUANTIFYING THE SOFTWARE TOOL OFFERING

As the customers' needs and expectations have shifted and as more needs have emerged over time, the ABB Drives software tool offering has gradually grown. Due to the complexity, organizational structures, and the sheer number of the tools, the knowledge about individual software tools was spread across the business unit, making the offering difficult to grasp. In the beginning of the study, the ABB Drives' Industrial design and User experience team did not have a detailed and holistic view over the software tool offering. Therefore, a bigger picture of the offering was to be pulled together and visualized in order to see the status, connections, user profiles, and the number of users of individual tools.

AIM

The first phase of the study focused on quantifying the software tools that the Drives software tool offering consisted of, as well as visualizing the gathered data into a more understandable format. For the Drives' design team, the visualizations were to serve as show-and-tell tools to see the extent and dependencies between the tools. The resulting files were to support knowledge sharing and potentially foster internal discussion about the current state of the offering. A key prerequisite was that both the resulting raw data, as well as the data visualizations could be easily shared, understood and updated as the offering evolves.

The results of this phase were also used to identify the case user profile and subsequently the user journey and case tools the study should be focused on.

SETTING DATA PARAMETERS AND GATHERING DATA

To keep within the scope of the study, only the tools owned by ABB Drives were to be considered part of the software tool offering. Tools used internally by ABB or partners were included in the study to see how they align with the tools intended for use of the customers' end-users. However, tools owned on ABB group level or by external suppliers, as well as discontinued tools were to be excluded. In addition, internal Excel tools were to be excluded, as they were not seen to qualify as software tools.

The relevant data parameters were identified together with client representatives as follows:

- » Name and description of tool
- » Associated drive life cycle phase (at which point(s) of the drive's life cycle the tool is associated with)
- » Tool category: Sales, engineering, etc.
- » Is the tool only used internally by ABB?
- » End-user profile (including both ABB and customer) side: sales person, R&D engineer, Sourcing manager, Field/maintenance engineer, System integrator/machine builder
- » Number of active users
- » Stakeholders (Product group, business owner, application owner, etc.
- » Technical (platform type, Drive model, dependencies, online availability
- » Status (current status, release year, current build, upcoming updates)

Once the parameters were set, an Excel spreadsheet was formed into which raw quantitative data was gathered from various internal and public databases online, as well as by interviewing key people across the business unit, both face-to-face and over Skype.

The resulting Excel spreadsheet contained a vast majority of the parameters set for each tool. In total, 162 individual software tools were identified, of which 62 tools were found to be qualified as part of the software tool offering.

RESULTS

The first phase of the study focused on quantifying the software tools that the Drives software tool offering consisted of, as well as visualizing the gathered data into a more understandable format. The resulting Excel file, as well as the visualizations, were shared in the organization to support knowledge sharing inside the business unit and to foster internal discussion about the current state of the offering. For the Drives' design team, the visualizations serve as a point-and-tell tool to easily sketch user's transition between the tools and to see the key dependencies between the tools and user profiles.

The resulting data visualizations (Figures 9 and 10) brought together the bits of data across the Drives business and thus painted a more coherent picture of the current state of the offering. Moreover, the Excel spreadsheet containing raw data was shared for later use, as it served as an easy-to-update data source and point of reference about the tools. In addition, it was later noticed that having a large picture benefited the software tool product managers as well.

DRIVES SOFTWARE TOOL OFFERING

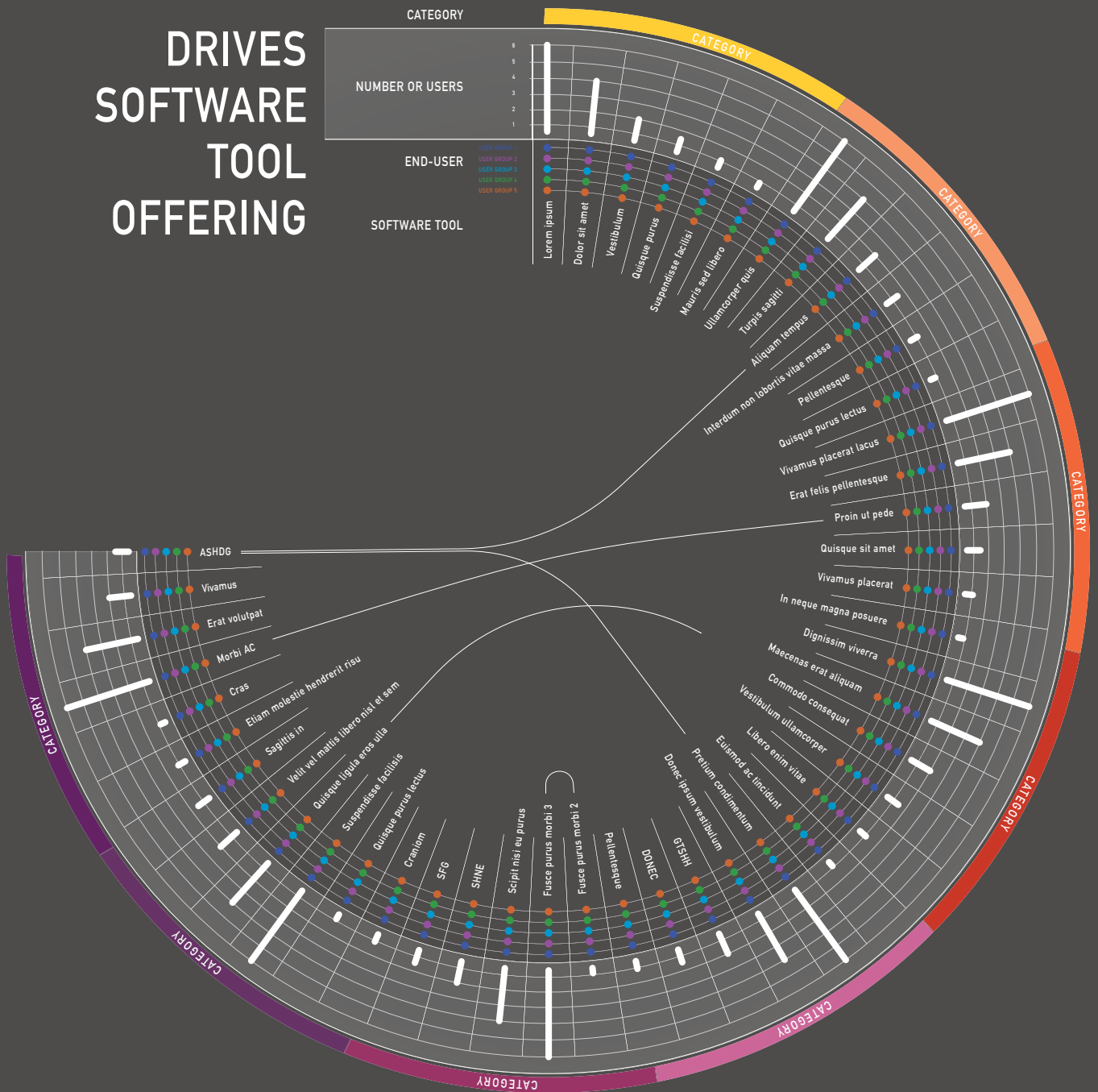


Figure 13: ABB Drives software tool offering. The visualization does not contain real data for confidentiality reasons.

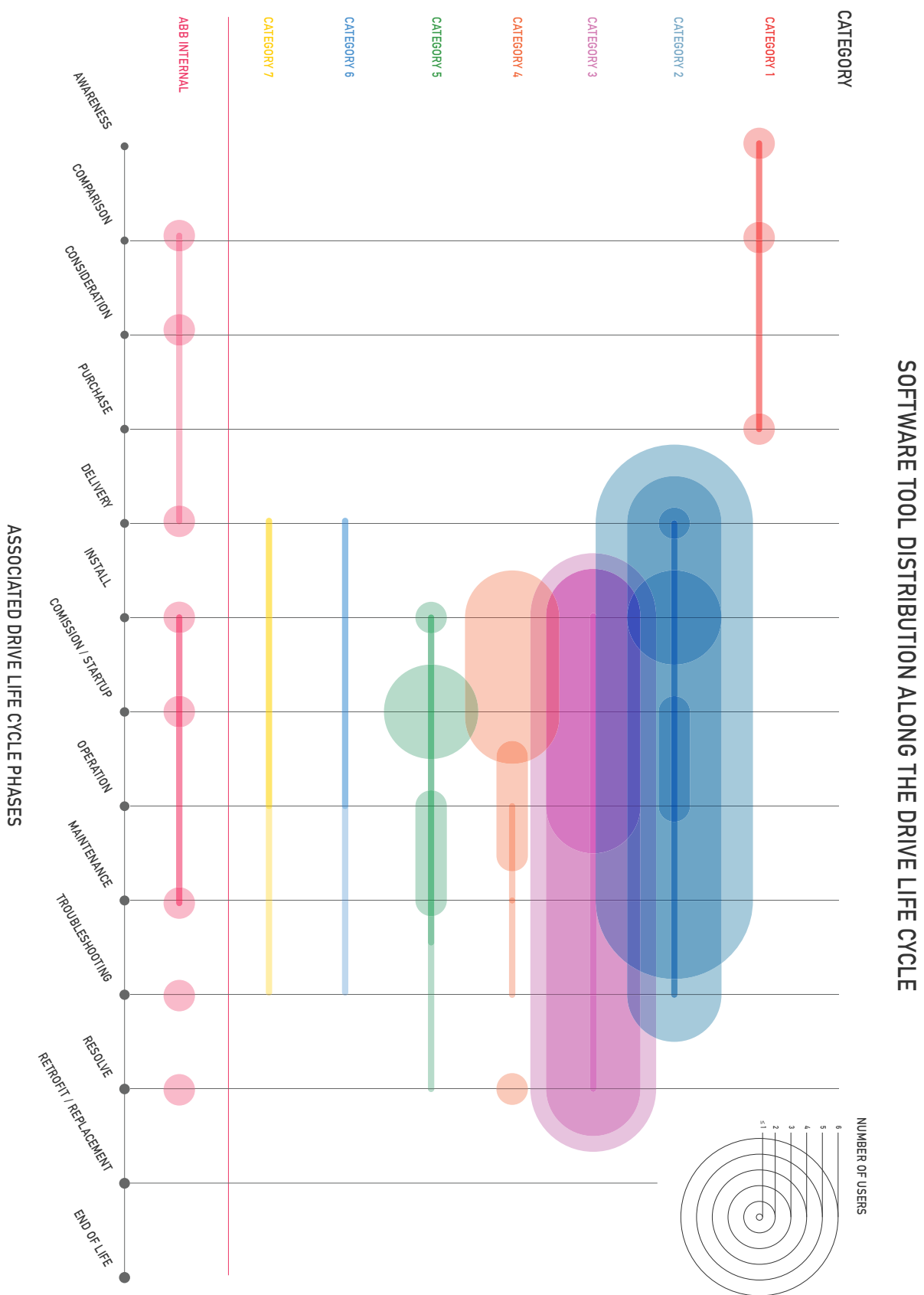


Figure 10: Software tool distribution along the drive life cycle. The data visualization does not contain real data for confidentiality reasons.

DEFINING THE CASE

Focusing on a life cycle phase

Given the sheer number and complexity of software tools in the offering, the study's scope was directed towards a specific part of the drive life cycle: the start-up/commission phase. This life cycle phase was selected, as it is the most saturated phase in terms of software tools; it includes a number of individual tools, having the largest number of individual users. Therefore, the research findings could benefit a larger, more defined user group, and potentially offer insight to guide the organization towards functional overlap in that area.

Setting the user profile and focus on specific software tools

Four case software tools were selected for closer inspection. These tools are labeled in this study as case tools A, B, C, and D. All of these tools fall under the *Start-up and maintenance category*. Although the case tools have various end-user profiles are often used for several other purposes (especially in the case of Tool B), they have a common user profile: Field engineers. Field engineers – also called Service engineers – operate the software tools in the field and at customer premises, often in direct interaction with the customer. Field engineers can be both ABB and partner representatives, or customer employees, and make up a significant portion of the overall end-users of the software tool offering. Due to these reasons, their user experience was seen as a key priority. Furthermore, a significant amount of user research about this user profile had already been made by

ABB, and the results of these studies could be accessed and used as a base for the research. Additionally, field engineers with different backgrounds and tasks could be recruited for the upcoming user research sessions from within the organization.

Defining the case journey and tools

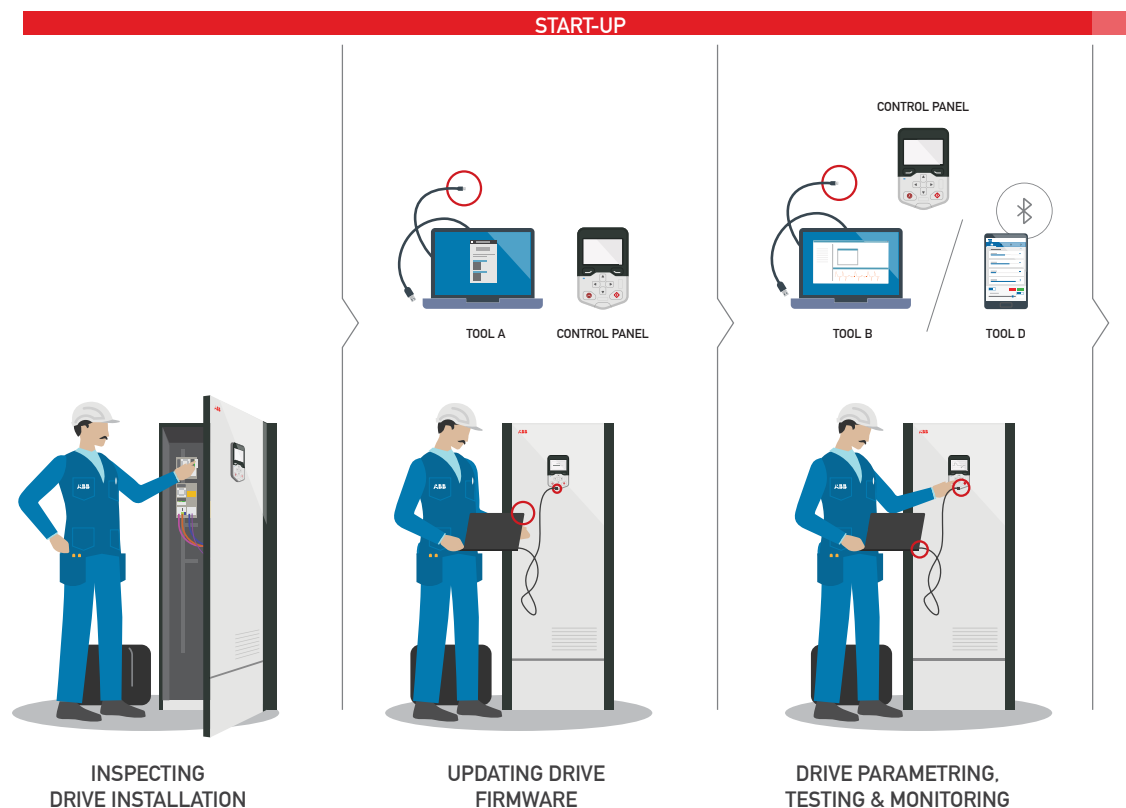
Once the scope was narrowed down to focus on a certain set of software tools and user profile, a typical work-related context in which the tools were used in was to be chosen – a task that was both typical to the users, and would potentially incorporate all aforementioned software tools along the journey. The defined task was defined as *starting up an installed drive on site, followed by drive registration and filing a start-up report*. This journey is typical to ABB and partner field engineers in general, yet it was known that the elements the task consists of differ per industrial application.

To confirm that it was possible for the given user to complete the journey using the selected tools, the journey was pre-validated together with one of the software tool managers (Figure 11). Already at this phase, it was noticed that the use of the tools was very much dependent not only the industrial application but also the user's own conventions and preferences. The task could be completed in more than one way, and due to this, in the upcoming research sessions, the use of the selected tools could be expected, but not dictated.

CASE SOFTWARE TOOLS ALONG THE START-UP-REGISTRATION-REPORTING-JOURNEY

Tool A is a PC software tool to check, load and update the firmware package of drives. The tool checks for the correct actual drive type and firmware version to load the package. It also checks for the correct drive application programming interface and programming license. (ABB 2015)

Tool B is one of the ABB customers' most commonly used software tools, intended for start-up and maintenance of ABB's common architecture ABB drives. The tool enables the user to view and set parameters, and to monitor and tune process performance. This tool provides features needed for local control of a single or multiple drives: setting drive parameters, process monitoring, and event logger handling. It is intended also for more complex environments where functionalities such as control diagramming and fast monitoring. Moreover, it includes macro script editing for parameters. Setting drive parameters with Tool B requires a physical USB, fiber optic or Ethernet cable connection to the PC via the Drive's physical assistant control panel for data to transfer. (ABB 2017).



Tool C was initially introduced in 2014. Intended for plant personnel, Tool C enables drives to be registered with the app by using a dynamic QR code generated by the drive, shown on the screen of the drive control panel. Additionally, the app enables access to product manuals and quick troubleshooting. Registering a drive also provides it an extended warranty. Tool C is used to maintain and service the drive fleet. It is an asset management tool providing lifecycle information of customers' drives in one or several plants, or in the case of integrator, all drives they are serving. The information is mainly cloud-based service recommendations, service contacts, phase of the drive life cycle info, and it can provide information which will optimize the value of the ownership of the fleet. (ABB 2017, ABB 2016)

Tool D was officially released in 2015. It is a free-to-download and free-to-use smartphone application used for quick and efficient start-up and tuning of ABB drives, providing the basic functions needed for start-up and troubleshooting of a drive, as well as access to ABB technical support. Tool D transfers data wirelessly between Android or iOS smartphone and ABB drive's control panel via Bluetooth within a range of 75 meters. The parameter view contains access to all drive parameters in the same manner as Tool B. (ABB 2017, ABB 2016)



Figure 11: Pre-validated user journey incorporating the use of the case tools.



- Home
- Dashboard
- Hardware
- Primary settings
- Full parameters
- About this app

Power and productivity
for a better world™ **ABB**

OBSERVING SIMULATED WORKFLOW

AIM

In order to understand the flow of the drive start-up procedure better and which elements the journey consists of, three semi-structured simulations were conducted with three expert users using a demo drive. This was to form a more hands-on understanding of how the experts work with the software tools when dealing with drives in specific situations, thus guiding the research focus towards the UX evaluation criteria that were relevant to the user experience in the context of this study. The simulations were followed by open questions that were modified to fit the scenarios imagined by the participants, to highlight potential issues they might face while proceeding with the steps. The session with participant C was more interview-based and relied more on the participants' personal experience and practical examples.

Acting as a facilitator in the simulation sessions with participants A and B, the author was assisted by one of the software product managers during two of the sessions to prepare the demo drive for the sessions. All three sessions took place in ABB Helsinki office premises in Helsinki. The sessions lasted between 60-90 minutes each, and they were recorded (audio and video) and photographed for later use.

PARTICIPANTS

As the tasks were to be completed based on the participants' previous experiences, they relied on the participants' memory. Therefore, it was highly crucial that the chosen participants were already familiar and experienced with the tools. These factors limited the recruitment to participants with sufficient expertise, technical knowledge, and work experience.

Three ABB drives technical experts were recruited to participate in the sessions. All experts had multiple years of experience working for ABB and with customers, and subsequently knew their way around the practicalities of the start-up procedure, as well as the technical characteristics of the ABB drive products. Given that the participants' work roles and backgrounds are all different, also their choice and use of the software tools was expected to differ to a degree.

Participant A works in ABB global technical customer support in Finland as Technical Support Specialist. His work is to help customers and ABB field engineers with troubleshooting and solving technical difficulties with ABB drives products, and therefore his technical knowledge about the start-up procedure and the drives products is profound. The participant has years of experience with ABB drives products and communicating directly with the customers and field engineers. He usually works from the office, and drive start-up at customer site is typically not his responsibility: according to him, 90% of the troubleshooting cases can be resolved without him going onsite in person. Given his work, he uses Tool B on a daily basis, among various other troubleshooting-specific tools that are not considered part of the ABB Drives software tool offering. The participant knows all case tools but has no field experience with case tools C and D.

Participant B works for ABB Sales & Technical Customer Support in Finland as Warranty & On-site Manager. With more than ten years of experience with ABB, he knows his way around the drive products, the start-up procedure in different environments, as well as communication with customers and partner representatives. He currently works with ABB's partner electricians dealing with HVAC (heating, ventilation and air conditioning) systems and is contacted when a customer needs support with challenging drives-related applications. The participant typically works through ABB Sales, yet some of his work takes place in the field at customer premises. The participant was well familiar with drive start-up-related tasks and the related software tools, including all four selected case study tools.

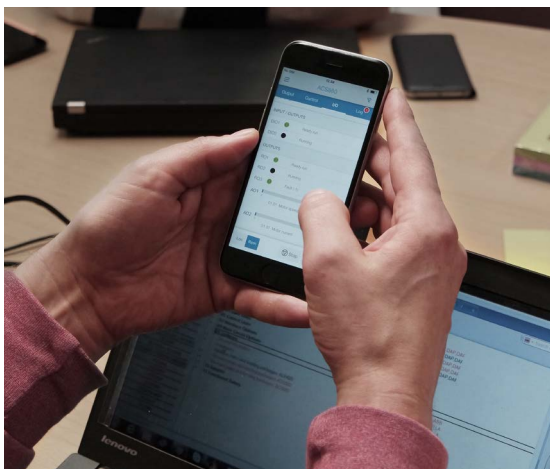
Participant C works for ABB domestic End User Sales as a Drive Technical Advisor in Finland. He works in product sales of individual ABB products, selling individual drives, logic controllers, motors, and other ABB devices. With more than 30 years of experience with ABB drives, he has acquired a consultative role in drive-related matters, working between manufacturing plants and customers. He

often joins sales personnel in customer meetings to provide assistance with complex technical drive-related matters. The participant has a significant work history in the field, but he nowadays focuses on teaching the use of drives, drive control panels and start-up-related software tools (mainly tools A and B) to groups of original equipment manufacturers (OEMs) and end-customers. Given this, the participant is highly proficient in the use of tools A and B. The participant had tested tools C and D previously, but had no practical field experience working with them.

SESSION PROCEDURE

The method used was semi-structured interviewing, combined with simulation and observation.

Before the actual drive start-up simulation, the participants were asked about their experience working for ABB, their work role, and typical work routines, as well as the software tools they use in their daily work. Both participants were encouraged to freely share their thoughts about the tools and the task.



Pictures 3 & 4: Participants simulating drive start-up using the case software tools and the drive control panel.

In the simulation phase (participants A and B), the participants were first asked to imagine a typical scenario in which the simulation was to take place. They were then tasked to perform the drive start-up procedure from start to finish the way they usually would, giving them the freedom to proceed with the process the way they saw fit. The participants were encouraged to think aloud and explain the reasoning behind their choices and actions upon proceeding with the use of the software tools.

After finishing the simulated procedure, participants were asked to share how well they think the tools support the task, and whether the procedure could be completed by using other tools instead of the ones they chose. The participants were also asked about the importance of registering a drive, and whether they see registration as a part of the start-up process. They were also asked how they perceive ABB in the light of the tools, and to share their suggestions and wishes for future development of tools based on their experience. Lastly, they were asked about the importance of bringing the tools closer together visually.

FINDINGS

Drive start-up is a nonlinear journey

According to the participants, the structure of the journey is always dependent on the context. The journey is affected by drive model, drive life cycle phase, industrial application, physical context, as well as the customer's role and requirements. Drive's life cycle phase, its connection to the programmable logic controller (PLC), previous changes in parameters and firmware version are all factors that are needed to be taken into account when performing start-up. The workload can also be shared and distributed between multiple work roles, requiring field engineers to interact with each other, as well as with partner and customer representatives. Due to the number of variables,

there is no official or universally applicable protocol for the start-up procedure, except from the technical point of view.

The field engineers may move back and forth between individual work steps along the journey. In the case of participant A, drive parameters were changed, their effects were monitored, and found anomalies were corrected by changing the parameters again, and the changes were then monitored again to make sure that the changes had realized. However, the participant noted that this kind of iterative work is typical to troubleshooting.

Based on the participants' descriptions, drive start-up is not seen as one isolated technical task, but rather as a journey that contains several work phases that have to do with drive start-up, drive registration and start-up reporting. A vast majority of the tasks the journey comprises of are related to the start-up procedure, and registration and start-up reporting are very short phases in comparison.

Choice of tools is influenced by user preferences and conventions

As expected, much of the conversation with the participants revolved around tools B, C and D. Participants A and B imagined a vastly different scenario for the simulation, leading to different approaches to the start-up procedure. Based on the participants' descriptions, drives can be started up by using the drive's physical control panel, Tool B, or Tool D. Participant C mentioned that he teaches the start-up process using both Tool B and the drive control panel and that ultimately the decision which one the customer wants to use is made by the customer.

Participant B's simulation scenario was HVAC related, typical to his daily work. According to him, HVAC applications are relatively straightforward from the technical point of view, and consequently

troubleshooting and start-up are relatively quick tasks to complete. He said that in such cases, he prefers direct interaction with the drive's physical panel as this eliminates quite a few steps and wait times, making the process faster. He added that using the drive control panel also means that he does not need to carry a laptop and cables with him at all times. However, participant B had not used Tool D's newest release, and upon testing it after the simulation, he was pleasantly surprised as it shows multiple drive parameters at once and is faster to interact with.

Compared to participant B's scenario, participant A's 'typical context' of choice was significantly more complex due to his line of work in technical support. The participant's journey included altering of parameters, multiple test runs, and process monitoring. The participant asserted that he uses Tool B for such cases, as the software's features enable him to be more thorough and careful in demanding situations. He did mention, however, that the way he himself uses Tool B is very thorough due to his line of work, and that such precision or technical knowledge is not expected from the local field engineers who usually perform the start-up using the tool.

Registration is not a compulsory phase of the start-up procedure

Registering a drive is important for ABB, as it tells the company where drives are located and how they are used, allowing ABB to offer their customers more context-specific service recommendations after the sale. Tool C was developed to enable drive registration onsite, where it can be performed by either ABB or customer representatives.

When asking about the importance of registration, one participant said that registration is important for the customer; although, given his line of work, however, he personally does not register drives. He added that in the end, registering the drive is up to the person who starts up the drive on site – it is not compulsory. Another participant, on the other hand, said that he would gladly register the drive during the site visit, given it was made easy. He sees registration as a rational thing to do, and that it can benefit both field engineers as well as the customer.

Start-up is a task that requires expertise

Start-up is performed by either local ABB representative: partner representatives, customer's own employees, and the end-customers themselves can all perform the task, depending on customer preferences and the complexity of the intended industrial application. Having said that, it is important to note that use of the software tools require industrial expertise from their users, as unskilled usage of the tools may easily result in serious process damage or safety hazards. Participant A emphasized that the successfulness of the task is highly dependent on the person's expertise, and although the engineers are taught to perform the start-up, real learning happens in the field.

The number of variables also creates room for user error. The participants perceive drive start-up as a fairly simple task from technical point of view, especially in the case of new drives in factory default settings. However, given that the journey consists of numerous steps, there is always room for user error. As put by one of the participants: *"when you have a million parameters, it is only natural that you forget something"*.

Waiting times and lack of system status frustrate and create uncertainty

Based on two of the experts' comments, it was found that waiting times are crucial to user experience. This includes the time the software tools take to launch, as well as the time it takes to transfer data between the drive and the tool.

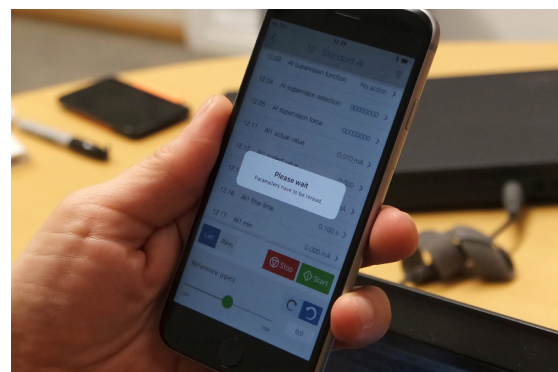
According to participants A and B, Tool B takes a long time to launch, and that the speed of the connection between the drive and the software tool over the cable is not satisfactory. When connecting to a drive, all of the drive parameters – of which there can be over 1,500 depending on the drive model and the industrial application – are all transferred between the drive and the software over USB (Pictures 5 and 6). This transfer is often needed to be repeated several times during the start-up process, including when creating or loading backups, updating drive firmware, and when changing drive parameters.

Participant B stressed that waiting times are the single most important reason why he usually

chooses to use the physical drive control panel over Tool B to start up a drive. In his experience, direct interaction with the panel UI is the quickest way to perform the start-up procedure in cases that only require changing a few parameters – a situation more typical to HVAC applications.

Two participants described the waiting times as frustrating, and that the waits are particularly vexing on site when the situation is critical and urgent actions are needed. In such situations, both participants mentioned that they feel the need to explain the wait to the customer, who is often looking over their shoulder while they operate the software.

One of the participants said that the worst thing about waiting is uncertainty – not being able to tell what is going to happen. He noted that there is no way of knowing if the connection between PC and drive is successful when first connected to a drive via cable. He added that he usually suspects faulty connection after a minute's wait.



Pictures 5 & 6: Data being transferred between drive and software tool.

Transition between work tasks is crucial to user experience

In the field, field engineers are required to switch tools when moving from one work phase to another. Considering the case journey, the user is required to switch between software tools when proceeding from one work phase to another. All participants noted that the individual tools do not acknowledge work tasks beyond their own specific and limited use cases. This discontinuity may lead to duplicate work and unnecessary work steps along the journey, frustrating the participants driven by work efficiency.

In case the field engineer is a ABB or partner employee, he typically needs to report the start-up work to the customer. In order for a field engineer to file the start-up report after drive registration, he needs to log in to a database maintained by ABB Drives. It is a website from where the user downloads the generic start-up report form in PDF format, to which he then manually fills the drive and customer information. As the report requires the customer's signature, the form needs to be printed on paper, delivered to customer for signing, and to be scanned. Only then can the report be uploaded back to the same database. Tool C utilizes the same database for drive registration, but the tool does not support reporting.

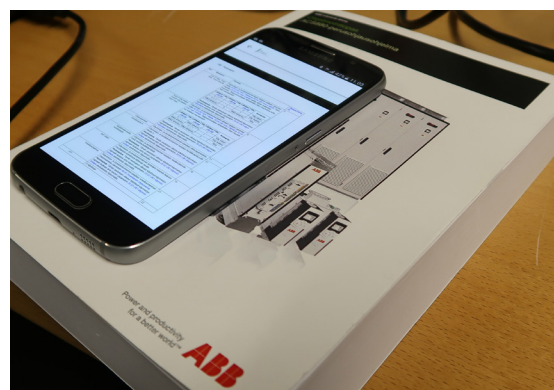
Product manuals are important sources of support but are not yet optimized for mobile

Product manuals include relevant information about the drive, such as exemplary values and limits for the drive parameters. The manuals are not only for the customers' use, as they are also often used in the field by ABB field engineers. These manuals were found to be extremely important sources of support and guidance for the participants, as knowing and remembering the myriad of drive models, parameters, drive settings,

and interdependencies is simply not possible. All participants frequently visit the manuals in their daily work to check certain product details and parameters.

The Tool B tool installation package includes most of the product manuals so they can be accessed on PC without internet connection. Tool C, however, relies on internet connection when fetching the manuals – each one is downloaded on demand. Tool D, on the other hand, does not have a product manual search feature. Participant C said that he prefers Google search when looking for specific manuals, which he said is the fastest and easiest tool to find specific parameters.

Once the user finds the manual in the language they want using Tool C, the whole manual is downloaded as PDF in the same A5 format it is printed on paper (Picture 7). Participant B mentions that searching for a single parameter is difficult as the user is required to know the correct spelling of the parameter by heart. It was noted by



Picture 7: Product manuals are not yet optimized for mobile.

two participants that it cannot be assumed for a customer end-user to be familiar with the jargon or spelling of parameters. Even with successful text search, the search often results in multiple hits, since parameters are mentioned multiple times in the manual that is often hundreds of pages long. For instance, downloading and opening the nearly 600-page manual of ACS880 drive took about 10 seconds with 4G connection on iPhone 6, and search with the word “encoder” resulted in over ten hits.

Furthermore, although the PDF manual includes a table of contents interactive bookmarks to paragraphs, participant B and C found that these bookmarks did not work on mobile. They were therefore required to skim through every search result to locate the piece of information they were searching for.

Wireless connection has potential, yet USB cables are still felt to be more reliable

All participants rely on USB cables when connecting to a drive using tools A, B or D. According to them, a standard USB is the easiest and most reliable method for data transfer.

Participant B mentioned that sometimes cable connection is the only available option to work with a drive in demanding environments, as drives are often installed in locations where there is no connection of any kind, such as basements or HVAC rooms (Picture 8). Hence this, working without internet connection is something the field engineer needs to be prepared for.

Participant B also declared that he cannot trust the reliability of Bluetooth connection onsite where heavy machinery may disturb the signal. He also mentioned that the Bluetooth connection may interfere with sensitive measuring instruments used onsite, such as oscilloscopes. Therefore, the most reliable way for data transfer is USB cable.

Participants are for visual improvements but fear that it would decrease usability or bring cumbersomeness

Quite surprisingly, the participants mentioned that they are for visual consistency, as long as the work is done lightly, and as long as being consistent with the brand does not override usability of the tools. Participant B said that although it would be pleasing for all of the tools to look the same, he was worried about the technical cumbersomeness these improvements might bring with them. Visual improvements, he worried, could prolong the waiting times, and thus decrease the tools' usability. Likewise, Participant C was for these improvements, as long as they would not affect the way the tools are used.



Picture 8: Using USB cable to connect to a drive at a customer site.

Broadening tool functionality is expected to support the participants' workflow

Given that the case tools – especially tools A and C – have highly specific use cases and platforms they work on, it is currently mandatory for the participants to change between software when transiting between consecutive work phases. The division and transition between the tools was found unnecessary by the participants. The participants' wishes for future development of the tools revolved around broadening the use case and flexibility of Tool B by merging the key features of other case tools into it. This, they said, would allow them to go through the journey without changing tools or devices in between different work phases of the start-up-registration-reporting –journey, thus making the flow feel more natural and effective.

Overall, the software tools have improved over the years

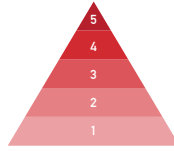
All participants mentioned that the situation with the tools has improved over the last few years, compared to the time before the generation of all-combitable software tools. Participant A mentioned that in comparison to ABB's competitors, the software tools are starting to be "up to date". Participant B concurred that the tools have taken a leap forward over the last few years. Participant B sees potential with Tool D and Tool C: *"We have a lot of potential with these (mobile apps). If only we had the time and resources to sand off the hard edges, we could make them work."*

Summary of findings

There are many ways to complete the start-up procedure, and the touchpoints the journey consist of vary greatly, although there are steps, such as parameter changes, that are always part of the start-up. In less complex cases, drives can be started up by changing parameters using the drive's control panel directly, meaning none of the software tools are needed – the choice of tools is always up to the person, and preferences and personal conventions play a big part in this, not only the suitability of the tool.

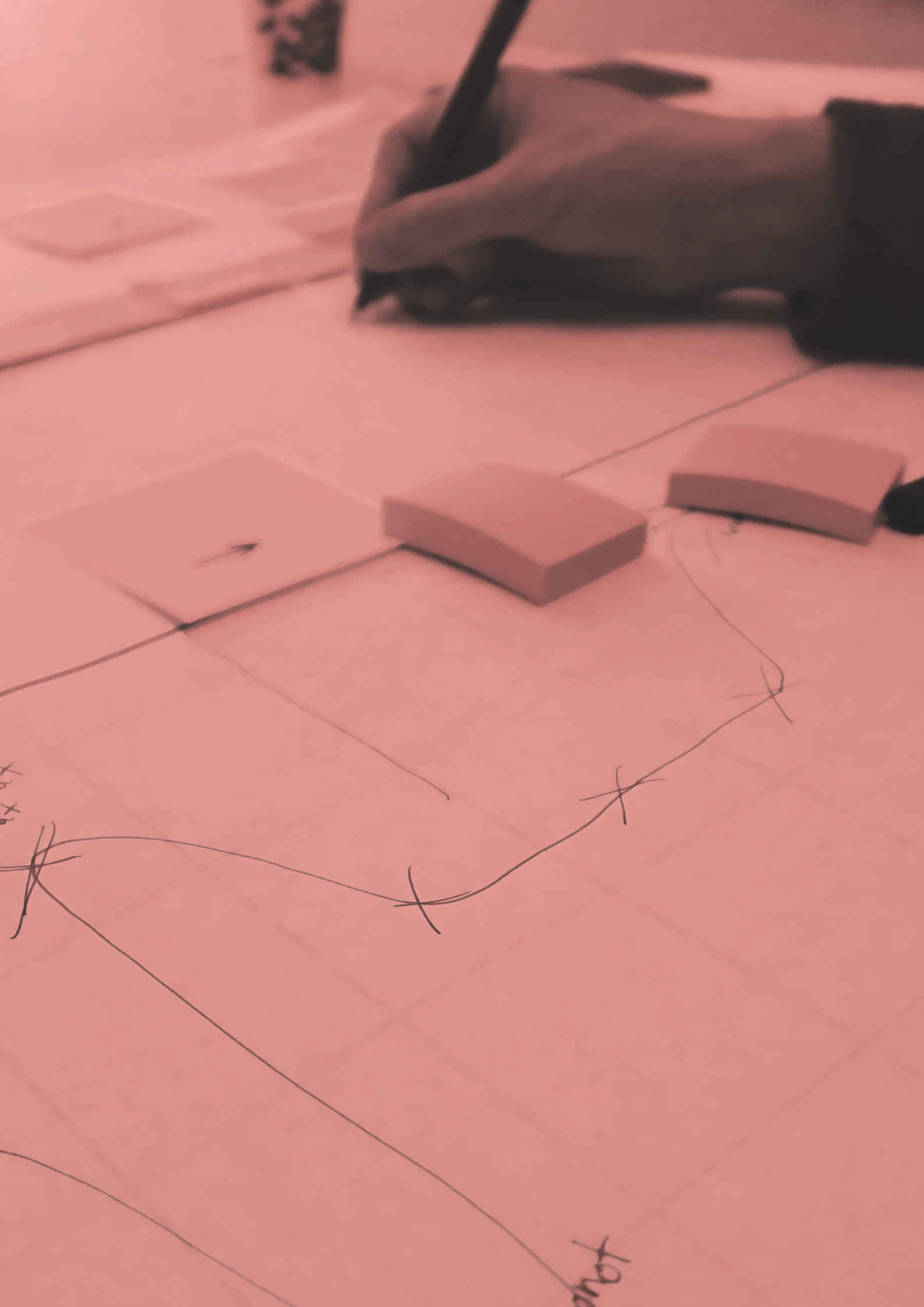
The most crucial software tool-related aspects affecting user experience are factors that directly affect the participants' workflow and efficiency: wait times related to launching the software tools and transferring data, and support and continuity between the tools when moving from one work phase to another. Two participants described the waiting times as frustrating, especially in critical situations that require working quickly, and when dealing with the customer face-to-face onsite. Surprisingly, the participants were worried that visual consistency of software tools could decrease the tools' utility by making the tools heavier to launch and run.

The found UX related issues, wishes and suggestions were cross-referenced to Kloczek's model of hierarchy of effort to fix a broken user experience (2012) and summarized in table 1.



ISSUES, WISHES AND SUGGESTIONS MENTIONED BY THE PARTICIPANTS	UX LEVEL REFERENCE (KLOCEK 2012)	CATEGORY	RELEVANCE TO UX (OBSERVED)
Launching times of software tools cause frustration (A & B)	3	System efficiency	High
Data transfer times between drive & tool cause frustration (A & B)	3	System efficiency	High
Lack of support between tools used along the start-up-registration-reporting journey (tool synergy) (B, C)	3-4	User workflow	High
Difficulties remembering details along the journey (A)	1	System usability	Medium
Difficulties in finding and using product manuals on mobile with Tool C (B, C)	1-2	User support	High
Tool B: insufficient fault identification & making suggestions to fix issues in Event logger (A)	2	System usability	Med
Tool B: monitoring icons are not descriptive and are missing tooltips	1	System usability	Med
Insufficient testing of tools while being developed (B)	4	User workflow	High
Working offline and in demanding environment (B)	3	Work environment	High
Insufficient screen size to monitor trend in Tool B (A & B)	1	System usability	Medium
Fitting registering and start-up reporting features to Tool B (A, C)	3	User workflow	High
Bringing Tool B to tablet (B)	3	User workflow	n/a
Visual inconsistency of tools	1	Brand & usability	Low
Enabling complete drive parameter back-ups on Tool B (C)	3	User workflow	n/a
Bringing drive parameter back-up functionality to Tool D (C)	3	User workflow	n/a

Table 1: Found UX related issues, wishes and suggestions.



INSPECTING MULTI-TOUCHPOINT USER EXPERIENCE

To add to the journeys described by the participants in the previous chapter, the following part of the study focused on evaluating the user experience of the drive start-up-registration-reporting journey by evaluating how the participants' user experiences change along the touchpoints, as well as to provide explanations for these changes. This was to identify software tool inconsistencies, common pain points, points of success, as well as how the end-users generally view the ABB brand based on their experience based on these tasks.

The first session took place at ABB premises in Vantaa, the second at ABB premises in Tampere, and the third one at ABB customer premises. The sessions lasted between 45 and 60 minutes each, and they were recorded (audio and video) and photographed for later analysis.

UX TIMELINE METHOD

Given that the task dealt with a specific journey and a longer time span, it could not be predicted accurately when and where similar tasks were to take place in the future. Hence the journey was selected to be re-enacted in retrospect by the participants in as much detail as possible.

The author developed a co-constructive 'UX timeline' method by combining customer journey mapping (Cruickshank 2011) and 'UX curve' method (Kujala et. al. 2011). Unlike typical customer journey mapping or UX curve (Kujala et. al. 2011), the modified method was intended to do both, a) identify crucial touchpoints the start-up-registration-reporting -journey consists of, and b.) evaluate the participants' user experience in the multi-tool environment along this journey. Moreover, as a co-constructive method, the method acted as a tool for both session facilitation, as well as documentation to be utilized later when visualizing the results.

Similar to the previous phase of the study, the resulting journeys were expected to be fairly complex and multi-phased, yet the primary courses of action were now fairly predictable. The tasks required the participants to use certain ABB software tools on more than one platforms and channels to be completed.

In practice, the timeline method included an A2-sized paper an empty, linear timeline, with ends representing the start and end of the journey, as well as Post-its, pens, and markers.

PARTICIPANTS

Unlike in the previous simulation session, the co-constructive task relied on the participants' previous experience and memory – it was crucial that the recruited participants were already familiar and experienced with the software tools, and had completed a similar journey several times before in the past.

Two experienced ABB field engineers and a field engineer from the end-customer were recruited for these sessions, of which none had taken part in the previous session of the study. Given the work roles of the field engineers, the recruited participants were all expected to be well familiar with the start-up-register-report -procedure in the field. The task could, therefore, be expected to be completed successfully by them. As the participants' working environments varied to a degree, the participants' choice of software tools was expected to differ. Due to this, the user experience, as well as the factors affecting it, were expected to vary in each journey. Both ABB field engineers were experienced professionals and regularly use the software tools offered by ABB Drives. The end-customer field engineer was familiar with Tool A, as well as ABB Drives' older generation software tools.

STRUCTURE

The sessions were commenced by asking a few questions:

- » Work experience
- » Work role and typical work tasks
- » Software tools used. Why these?
- » What does good user experience mean to you? What does it consist of?
- » What does good user experience mean in the work context?

Next, the timeline method and the task was introduced. The participants were asked to choose a typical scenario for a drive start-up, registration, and reporting. They were then tasked to craft this

journey on the timeline by writing down the phases it consisted of on Post-its and place them on the journey. The participants were encouraged to think aloud and describe their interactions as they proceeded with the task, and emphasized to write down any additional information they saw relevant on Post-its or the timeline for documentation.

Once finished constructing the journey, the participants were asked to evaluate their own user experience in each touchpoint on a scale of 1 to 4 (1 very bad (frowny face) - 4 very good (laughing face)) and draw a graph to match their experience in each phase of the constructed journey. Highest and lowest points were then discussed with the participant to find out the participants' motives for these scores. They were also asked to add an estimation of how long it would normally take to complete the journey they had described.



Picture 9: A participant evaluating his user experience.

Once finished, the session was continued with interview questions that were planned based on the results of the previous phase of the study:

- » How well do the software tools support your transition between work phases based on this journey?
- » How well do the software tools work from work efficiency point of view in this task?
- » How well do the software tools bring out your own professionalism?
- » How well do the software tools meet the requirements that you face in the field?
- » The software tools are being developed to be more visually consistent. How do you think this affects your own user experience?

Lastly, the participants were asked to give their ideas for improving the software tools.

The sessions were recorded, and the resulting timelines were photographed to be visualized and analyzed in the next phase of the study.

VISUALIZING THE JOURNEYS

The constructed journeys photographed in the sessions were used as the base of visualizing each user journey. Recordings were listened while visualizing the journeys to gather the contextual comments and suggestions mentioned by the participants.

The resulting UX timelines were later evaluated together with the client.

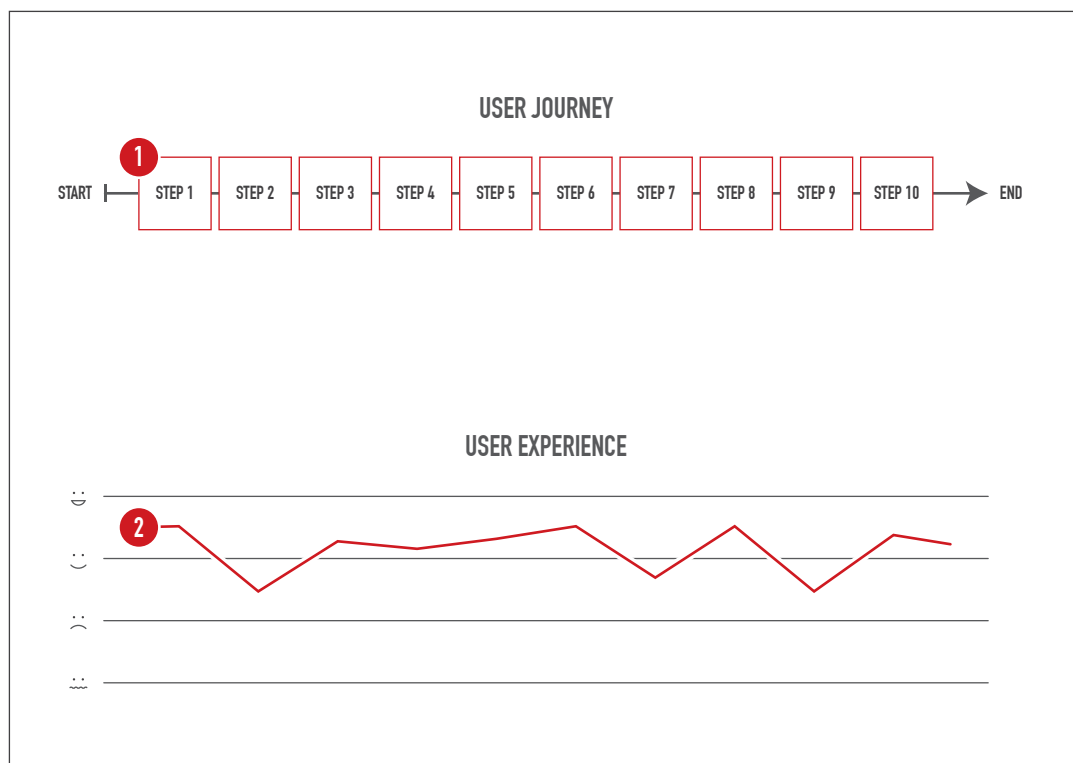


Figure 12: The main principle of the 'UX timeline' method.

ROLE

FIELD ENGINEER

CONTEXT

STARTING UP ACS 880-X

LOCATION

AT CUSTOMER SITE

WORK PHASE

START-UP

JOURNEY

Vestibulum
ullamcorperDonec placerat
leo sit
ullamcorperProin in dolor
mauris

Vivamus placerat

Proin

Cuctor
vulputateQuisque sit amet
dolorAliquam tempus
nisi ini

Dui enim

In-



TOOL / SYSTEM

TOOL A

TOOL B

Extremely good

Somewhat good

EXPERIENCE

Somewhat bad

Extremely bad

Lorem
ipsum dolor
sit amet,
consectetuer
adipiscing
elitLorem
ipsum dolor
sit amet,
consectetuer
adipiscing
elitLorem
ipsum dolor
sit amet,
consectetuer
adipiscing
elitLorem
ipsum dolor
sit amet,
consectetuer
adipiscing
elit

"Sed posuere
interdum sem.
Quisque ligula eros
ullamcorper quis,
lacinia quis facilisis
sed sapien."

"Vestibulum id justo
ut vitae massa. Proin
in dolor mauris
consequat aliquam.
Donec ipsum!"

"Quisque
purus lectus,
posuere eget"

"Sed posuere
interdum sem.
Quisque ligula eros
ullamcorper quis,
lacinia quis facilisis
sed sapien."

"Vestibulum id justo ut vitae massa.
Proin in dolor mauris consequat aliquam.
Donec ipsum!"

COMMENTS

"Quisque
purus lectus,
posuere eget"

"Sed posuere
interdum sem.
Quisque ligula eros
ullamcorper quis,
lacinia quis facilisis
sed sapien."

"Sed posuere
interdum sem.
Quisque ligula eros
ullamcorper quis,
lacinia quis facilisis
sed sapien."

"Sed posuere
interdum sem.
Quisque ligula eros
ullamcorper quis,
lacinia quis facilisis
sed sapien."

"Sed posuere
interdum sem.
Quisque ligula eros
ullamcorper quis,
lacinia quis facilisis
sed sapien."

USER'S SUGGESTIONS

"Quisque
purus lectus,
posuere eget"

"Quisque
purus lectus,
posuere eget"

Figure 13: Example of a resulting 'UX timeline' visualization. The visualization does not contain real data for confidentiality reasons.

XXX DRIVE IN A CRUISE VESSEL

DURATION

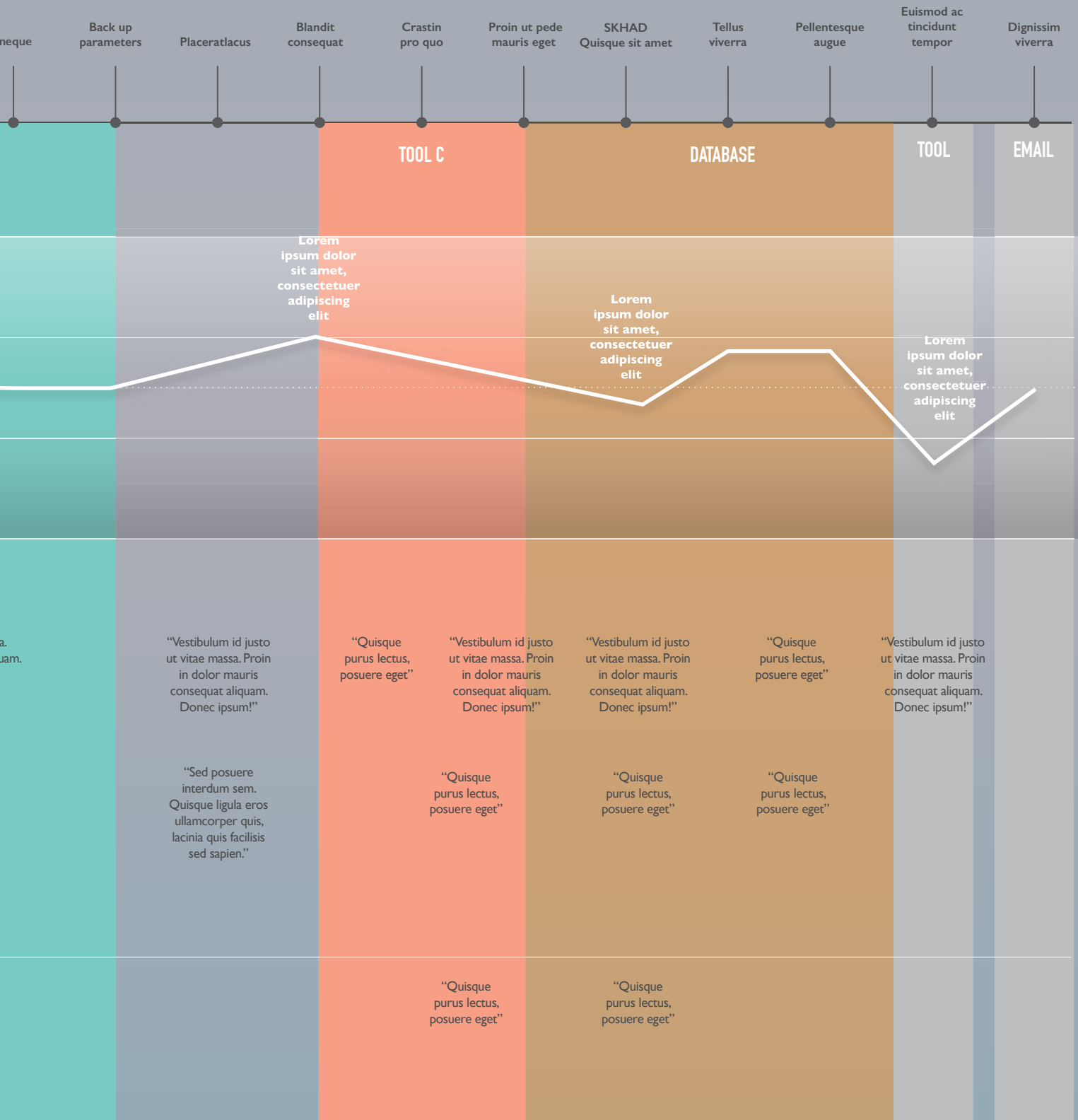
1 DAY

DURING TRAVEL

AT OFFICE

REGISTER

REPORT





30-4A1

INTERNAL FAN
BLOWING DIRECT

Dangerous voltage
Wait 5 minutes after
disconnecting
supply before
proceeding.
See User's Manual

LATTIMER INNOVISTA

FENA-21

CONCLUSIONS & DISCUSSION

This thesis documented a case study of how user-centric, service design-based research methods can be utilized to evaluate the user experience of user journeys that involve user interaction with multiple digital systems. The case concentrated on ABB Drives and four case software tools (digital systems) that are part of the organization's software tool offering. The case users were field engineers, with the evaluated case user journey being drive (frequency converter) start-up, registration and start-up reporting in industrial environments.

It was found that utilizing user-centric, service design -based research methods is suitable for both evaluating and documenting journey-specific multi-touchpoint user experiences that include the user to interact with multiple separate digital systems in order to complete a specific work task.

Positioning into the intersection between service design and user experience design, the case study provided a practical application of "multi-touchpoint experience design", a largely unexplored field of study.

MEETING RESEARCH OBJECTIVES

The objectives set for this study were:

1. Map the extent of the current software tool offering and visualize it (first design deliverable).
2. Identify the aspects that affect user experience of a case journeys of an end-user profile
3. Based on the study results, make recommendations on how to proceed to harmonize the software tool offering from consistent user experience standpoint (second design deliverable – partially undisclosed)

All set research objectives were met. The first objective was covered in chapter *Quantifying &*

communicating the software tool offering by mapping the software tool offering into a shared Excel sheet, from which the key findings were visualized into two information visualizations to be shared and maintained in the organization. The second objective was met by defining the aspects affecting contextual user experience in chapters *Theoretical background*, *Observing the simulated workflow*, and by evaluating the user experience in *Inspecting the multi-touchpoint user experience*. The third objective is covered in this chapter and in chapter *Taking action*. However, the results of the third objective are discussed on a more general level: conceptual suggestions on how to improve the contextual user experience regarding the case tools remain undisclosed for confidentiality reasons.

ANSWERING TO RESEARCH QUESTIONS

"What is good UX in the context of this study?"

In chapter *Theoretical background*, the concept of UX in the context of the case study was defined as follows:

User experience (UX) is the subjective experience that is formed when an end-user, regardless their role and relationship with the organization, interacts with ABB Drives through multiple software tools part of the offering, across intended platforms and channels during the timeframe of completing a specific task or journey.

On a more general level, this definition can be broken down into the following parts:

- » UX is subjective to the person using the systems
- » UX forms through interaction with multiple systems
- » UX forms through intended platforms and channels
- » UX forms through the time a task or end-to-end journey is being completed

Based on the results of the study, the terms of 'good UX' are:

- » Performance, reliability, functionality, efficiency and ease of use of systems
- » Consistency in the way individual systems function
- » Seamlessness of transition between work phases
- » Supporting the user's feeling of professionalism
- » Compatibility with demanding working environments
- » Enabling the user to accomplish as much as possible keeping within the borders of one system

As experiences are subjective and contextual, this definition is based only on the comments and journeys of those users who took part in the case study, and hence it is not universally applicable to all of the software tool offering.

It is concluded that before UX can be found as 'good' or 'bad', the factors that matter to the users need to be discovered in order to define what exactly makes a good experience for *them* – the relative importance of aspects affecting UX comes from the users themselves. As such, the terms of good UX cannot be set from top-down, but from bottom to up: only the actual users can dictate what matters to them the most, and what makes them most satisfied with their situation, the work tasks, and ultimately the software tools they work with.

It is worth mentioning that although the users stated that efficiency is the most important factor when it comes to their overall user experience, making a system as efficient as possible does not guarantee a good user experience for all of the user base. Therefore, mapping user needs and goals and finding the balance between is key. This requires a larger sample of end-users, the correct research methods, planning, user testing, and resources.

“What is consistency and how is it relevant to user experience in this context?”

Visual consistency is the foundation to start harmonizing the whole offering by bringing the tools under the same umbrella (Klocek 2012). Consistency on the level of fonts, color, style and nomenclature of software tools is argued to be a powerful way to promote that the tools belong under the same brand. At this level, the implications of visual consistency are mainly aesthetic and related to brand visibility, yet visual consistency has may boost the usability of individual user interfaces by improving discoverability and legibility of information. Applying visual and behavioral consistency to user interfaces is mainly principle based, and individual user interfaces can be brought closer together following the set guidelines. Thus the coverage and quality of the guidelines – and the research put into the design of the principles – is of key importance.

As demonstrated by this study, there is more to delivering consistent user experiences beside excelling in consistent UI design. As the contextual terms for 'good UX' suggest, many aspects that were found to be of high importance to UX are not restricted to design of user interfaces per se. Seamlessness of workflow, user transition between channels, physical work environment and the user's feeling of professionalism were all found to be key factors that affect the user experience. It is therefore concluded that both pragmatic and hedonic factors affect the user experience, and that both touchpoint and journey levels are to be considered in order to deliver holistic, optimized and consistent user experiences.

“What are the benefits and risks of introducing consistency to a large digital product offering?”

The results of this study support the organization's imitative to introduce consistency to a large digital product offering, as such work has many potential benefits as discussed above. On touchpoint level,

a visually consistent offering may appear more coherent with the corporate brand, and therefore more recognizable in the eyes of the end-users and customers. On user journey level, on the other hand, skillful management of end-to-end user experiences may lead to enhanced customer satisfaction, customer loyalty, increase in revenue, and greater employee satisfaction (Rawson et. al. 2011, Sundberg 2015). Moreover, focusing on optimizing user workflow may result in a more compact software tool offering that is leaner to manage and to offer to customers in the organization. Thus, the benefactors of consistent user experiences are all three: the end-users, the customers, and the supplier company.

As for the risks: some participants worried about the cumbersomeness that visual consistency of user interfaces might bring, overriding usability and functionality of the tools. Apart from this, no risks regarding consistency were identified as part of this study.

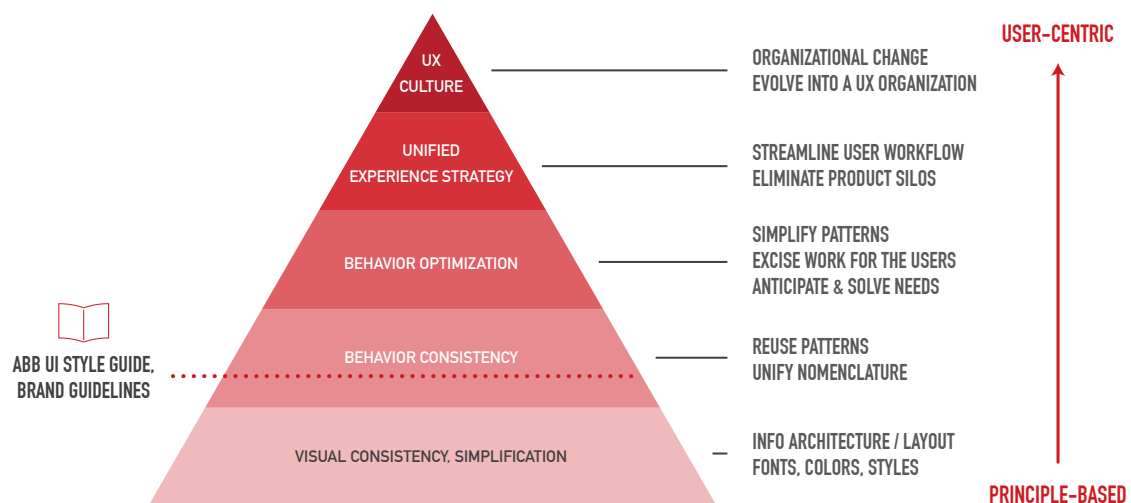


Figure 14: The hierarchy to fix a broken user experience. Modified from Kloczek (2012).

“How can a user-centric approach help in harmonizing a large software tool offering”

The significance of user-centricity was found crucial in harmonizing a large software tool offering. It is concluded that user-centric research and service design methods are effective in identifying user needs and motivations, evaluating user experience, and interpreting user insight to optimize user workflows on both touchpoint and user journey levels. This study provides a practical example of how user-centricity can be applied to such work. However, the study only covers only one user journey with four case tools, and thus extensive research is needed to understand what is required of other products that are part of the Drives software tool offering.

User-centricity is inseparable from user experience design, and the more consistent user experiences the organization aims to deliver, the more significant the role of user-centricity becomes in the organization. Indeed, without comparing the offering against the users' needs and goals, it is not possible to decide what user work patterns to simplify, what work to excise and what user needs to anticipate (Klocek 2012). The organization's objective to deliver meaningful and consistent user experiences throughout the software tool offering calls for in-depth understanding about the why, how, where and by whom the software tools are used. Thus, it is crucial that individuals who first-handily interact with the software tool offering are heard, and that their needs and motivations are comprehended and brought forward in new product development. User research and involving users in the product development process is argued to benefit the supplier company by decreasing the risk of ending up with products that the users do not accept (Sundberg 2015). On the touchpoint level of design, rich and comprehensive user insight works in compliance with the corporate brand guidelines and UI style guidelines, thus supporting the design and development of new user interfaces.

DISCUSSION & FUTURE WORK

The theoretical background and the definition of user experience position this study in between user experience (UX) design and service design. Moreover, due to the holistic and multi-touchpoint nature of the case, the thesis connects with the field of multi-touchpoint experience design (MultiXD), a largely unexplored research field, coined by Roto et. al. (2016).

Literature review indicated that there is a lack of user experience evaluation methods suitable for evaluating user experience of user journeys that include user interaction with multiple separate digital systems over time. Although service design focuses on optimizing experiences by focusing on user/customer journeys, as well on coordinating the multiple channels through which services are delivered (Miettinen 2017), methods for evaluating and quantifying said experiences have remained undocumented in academic literature. That said, the author's own experience in UX design and service design fueled the formation of the UX imeline method. The UX timeline method, developed by the author, is based on user research methods commonly used in service design practice. Therefore, it is essential for design practitioners and researchers to bear in mind that the most suitable tool for research might not be found in academia, but from design practice.

Much of the knowledge and methods that exist in service design originate from design practice and case studies (Miettinen 2017). In service design practice, methods are often modified and combined to be used for a variety of needs. Both service design and UX design are based on the principle of prototyping and iterative development, and the situation is no different when designing the research methods themselves. As this case study demonstrated, it may be helpful to combine research methods of other human-centric, experience-related research fields to provide a more holistic perspective to cover the complex concept

of experiences that fit the context. In fact, the field of service design encourages designers and researchers to craft and modify research methods that cross the boundaries of individual disciplines – something that designers are innately prone to do (Miettinen 2017).

The major findings uncovered in this study would have gone unnoticed if the study would have been carried out focusing too strictly on the way experiences are viewed in HCI or omnichannel design: HCI focuses on evaluating UX of individual systems, whereas the approach in omnichannel design includes all customer interaction with the organization, both direct and indirect. The definition of UX used in this study, as well as the formation of the UX timeline method only add to the fact that defining or evaluating UX is not straightforward to begin with – as experiences are always subjective and tied to a context, and since organizations may aim for different kinds of experiences, a universally applicable definition of 'good UX' cannot exist. (Kaasinen et. al. 2015).

UX timeline as a method for evaluating multi-touchpoint user experience

The co-constructive UX timeline was found suitable for the task to evaluate multi-touchpoint user experience that takes place in industrial settings and involve the end-user to interact with multiple digital user interfaces along the journey. However, it is important to note that the suitability of the method is based on the author's own observations around one case study only, and its credibility cannot be verified without further research on the topic. The method was developed to fit the needs of the case and should therefore be considered as

a prototype rather than as a ready-made method for evaluating multi-touchpoint user experiences. Moreover, considering the complex nature of experiences and the myriad of factors affecting it, the method should be coupled with other research methods to provide a richer description of user experience.

The benefits and limitations of the UX timeline method the author observed are noted as follows:

Benefits from research planning point of view:

- » Suitable for relatively complex journeys that require the user to interact with multiple tools
- » Suitable for user journeys that do not have fixed work steps
- » The number of involved digital systems is not limited
- » Enables the start and end points of the journey to be defined beforehand
- » Documents the transition phases between the user's transitions between individual systems or touchpoints
- » Enables a controlled research environment and predictable location, time, and duration
- » Enables a longer timespans and disjointed tasks be 'compressed' into one visual journey
- » Enables the end-results to be documented, digitized and analyzed as-is without data loss
- » Quick and inexpensive to set up using common office materials
- » Provides a common language and benchmark for the interview questions following the exercise

Benefits from data gathering point of view

- » Low learning curve – it does not take much explaining for the participant to understand the purpose of the method
- » Enables the participant to demonstrate their way of thinking without relying only on verbal communication (tangibility)
- » Shifts the participant's focus towards *transition between touchpoints*, instead of focusing solely on individual systems
- » Guides focus on both pragmatic and hedonic aspects affecting the journey separately, making an ambiguous experience more manageable
- » Gives freedom to move back and forth between steps, and to add and rethink actions at any given time
- » Helps the participant think aloud, explain and verify their actions as they proceed
- » Telling a story aids the participant to recall details and share exemplary cases

Limitations

- » Requires involving participants who are familiar with the context and the systems
- » Relies on user memory of past experiences, and does not therefore evaluate user experience in real-time
- » Fidelity of results needs to be defined beforehand (how detailed information is really needed) to guide the participant and ensure consistent outcome
- » Does not provide quantifiable or comparable results given that the resulting journeys may differ – especially in cases where there are various possible ways to complete the journey
- » The sessions are to be recorded and/or videoed to ensure contextual coherence between work steps and participant's comments

SELF-REFLECTION

To the complexity of experiences – and to the experience of complexity.

I am grateful to ABB Drives to have gotten a chance to work on this case as my master's thesis project. The inherent intricacy of the concept of experiences and the previously unknown world of frequency converters certainly pushed my skills as a designer.

Getting a grasp of the highly technical world of frequency converters was challenging to say the least. Although I had some previous experience in both UX design and service design, as well as doing research for business-to-business clients, my previous knowledge about engineering and the industry ABB Drives represents was next to

nothing. The learning curve was steep from the very beginning of the project, and making sense of all the dependencies, tools, and the mouthful of abbreviations used in the organization required commitment and full immersion to the topic – there was so much information that I was expected to absorb, and at times it was difficult to keep track of what was important and what information truly guided the process towards the goal of the study. The wideness of the topic, the clear lack of academic literature, confidentiality issues, and the strict time span all posed challenges, yet the main difficulty was that user interviews were delayed close to two months, and it is undeniable that this would not have affected the outcome of the thesis.

Looking back at the project, there are a few things that I would like to note. Firstly, it takes time to orientate oneself into a project so broad, and it takes even longer to get to know the context on a deep enough level to make justified decisions. Secondly, as a designer, I am used to working in teams where information is shared and ideas are discussed freely on a daily basis. A thesis, however, is an individual project in which one is expected to carry out all of the work individually. Having a personal connection with people who truly understand the context is therefore key.

Despite of the clear lack of academic literature on evaluating multi-touchpoint user experiences, I was able to select, broaden and utilize research methods that I had learned and used at both school and work. In the end, these methods complemented each other quite successfully and resulted in rich data I had hoped for.

All things put together, I am proud of my work, and satisfied with the outcome of the project. This project certainly placed a personal benchmark for future work, and I look forward to see how the results of this study are taken forward in the client organization.



TAKING ACTION

This chapter answers to research objective 3: *Based on the study results, make recommendations on how to proceed to harmonize the software tool offering from consistent user experience standpoint.*

The conceptual approach described in this chapter is based on the results of this study, and is shared under the permission of ABB Drives. Concept designs and practical recommendations regarding ABB Drives are specific to the case tools, and will thus remain undisclosed.

The approach is not strictly limited to ABB Drives, and may be utilized by other organizations that seek to improve user experience of offerings that consist of multiple interdependent systems used by several user profiles.

A USER-CENTRIC APPROACH TO OPTIMIZING MULTI-TOUCHPOINT USER EXPERIENCE

The higher the organization's expectations are in delivering consistent user experiences, the more user-centric the new product development culture is to become. Such an initiative requires a strategic, user-centric mindset. That is to say that user-centricity is to be approached as a shared organizational philosophy that strives to keep user insight in the loop throughout the development process, rather than applying it to certain phases of development. Designers undeniably play an important role in this initiative, yet considering the holistic, multi-touchpoint nature of consistent user experiences, the initiative demands organizational changes, multidisciplinary involvement, and commitment from all stakeholders who take part in new product development in the organization.

Rawson et. al. (2013) argue that organizations that wish to manage the experience of whole journeys are obliged to 1.) identify the journeys in which they are to excel; 2.) understand how well the organization performs in each; 3) create processes

to redesign and support the journeys; and finally 4) foster cultural change and strive for continuous improvement to sustain the initiative.

To meet the first three requirements, a conceptual process is presented as an example of a user-centric approach to optimizing end-to-end user experience of the Drives software tool offering (Figure 15). The approach utilizes both the offering visualizations and the UX timeline method that resulted from this study.

Such initiative may be deployed incrementally by focusing on individual user journeys at a time. Therefore, the approach does not radically interfere with the active state of the offering, as resulting conceptual and beta solutions can exist in parallel with the existing software tool offering for the time being developed and deployed in larger scale. Considering the sheer number of software tools, possible user profiles and their work tasks, extensive user research is needed for the initiative to be completed in full.

The outcomes of such initiative would likely result in mergers of individual software tools through merging their key features and functionalities as larger entities, and to discontinuation of some individual software tools altogether. Thus, change resistance can be expected from inside the organization, and therefore a strong, high-level mandate to successfully bring the objective forward in the organization (Klocek 2012, Mäkelä 2017). Therefore, the following 'recipe for success' (Mäkelä 2017) is added for the work to be taken into action in the organization to cover the fourth requirement of managing end-to-end experiences (Rawson et. al. 2013):

- » Someone needs to have ownership and responsibility to develop the topic
- » A core team of professionals is needed to be officially involved
- » Designers need to show the purpose of their work and integrate themselves into the organization
- » Leaders need to be aware of the power of user-centric design and design thinking



Figure 15: A user-centric approach aiming to optimize multi-touchpoint user experiences.

REQUIRES

USER-CENTRIC, HOLISTIC VIEW
STRONG ORGANIZATIONAL MANDATE
MULTIDISCIPLINARY WORK
DEDICATION
SERVICE DESIGN METHODS

CONSIDERS

USER WORKFLOW
CHANNELS TRANSITION
SUPPORT STRUCTURES
BRAND DELIVERY
SYNERGY BETWEEN SYSTEMS
SOCIAL INTERACTIONS
WORK ENVIRONMENT

ENHANCES

USER WORK MOTIVATION
USER WORKFLOW
USER SELF-ACTUALIZATION
WORK QUALITY & SAFETY
BRAND ACTUALIZATION
RESOURCE PRIORITIZATION

USER JOURNEY OPTIMIZATION

How to support the user to complete the task?



DIGITAL TOUCHPOINT OPTIMIZATION

How to make the digital system perform the best way possible?

REQUIRES

USER RESEARCH & UCD DESIGN
GUIDELINES & PRINCIPLES,
PROFESSIONAL DESIGNERS

CONSIDERS

USABILITY
INTERACTION
AESTHETICS
USER GUIDANCE
BRAND PRESENCE
INFORMATION FLOW

ENHANCES

FUNCTIONALITY
EASE OF USE
USER SATISFACTION
WORK EFFICIENCY
BRAND VISIBILITY

REFERENCES

ABB (2016). ABB: Next stage of unlocking value. [online] New.abb.com. Available at: <http://new.abb.com/news/detail/222/abb-next-stage-of-unlocking-value> [Accessed 21 Feb. 2017].

ABB (2016). ABB drives go mobile – Drive data in your own pocket [online] New.abb.com. Available at: https://library.e.abb.com/public/19e621bb0a3040a6a9d04a63bc6e5b46/13221_ABB_Drives_go_mobile_infographic_hires_without_bleeds.pdf [Accessed 12 Apr. 2017].

ABB (2017). Drive composer - ABB Drives. [online] New.abb.com. Available at: <http://new.abb.com/drives/software-tools/drive-composer> [Accessed 12 Apr. 2017].

ABB (2017). Drivetune - commissioning and managing drives. [online] New.abb.com. Available at: <http://new.abb.com/drives/mobile-tools/drivetune> [Accessed 12 Apr. 2017].

ABB (2017). How two apps can improve the performance of your drives [online] New.abb.com. Available at: <https://www.abb-conversations.com/2015/09/how-two-apps-can-improve-the-performance-of-your-drives/> [Accessed 12 Apr. 2017].

ABB (2015). Programming manual – Drive application programming (IEC 61131-3) [online] (1st ed., pp. 80-85). Available at: https://library.e.abb.com/public/0c2d308c60de4f8299cf554992b9581b/EN_ACS880_Drive_appl_prg_UM_D_A4.pdf [Accessed 24 Apr 2017]

ABB (2017). What is a drive - ABB Drives. [online] New.abb.com. Available at: <http://new.abb.com/drives/what-is-a-drive> [Accessed 21 Feb. 2017].

Brown, T. (2009). Change by design: how design thinking transforms organizations and inspires innovation. 1st ed. New York: HarperCollins Publishers.

Clatworthy, S. (2011). Service innovation through touch-points: Development of an innovation toolkit for the first stages of new service development. *International Journal of Design*, 5(2), 15-28.

Cruickshank, P. (2011). Customer journey mapping. *Smart Cities Guide*. Available at: <http://www.iidi.napier.ac.uk/binary/dl/file/publicationid/13373184> [Accessed 24 Apr. 2017].

Flaherty, K. (2016). How Channels, Devices, and Touchpoints Impact the Customer Journey. [online] Nielsen Norman Group.com. Available at: <https://www.Nielsen Norman Group.com/articles/channels-devices-touchpoints/> [Accessed 21 Feb. 2017].

Hassenzahl, M. (2014). User Experience and Experience Design. In: Soegaard, Mads and Dam, Rikke Friis (eds.). *The Encyclopedia of Human-Computer Interaction*, 2nd Ed. Aarhus, Denmark: The Interaction Design Foundation. Available online at https://www.interaction-design.org/encyclopedia/user_experience_and_experience_design.html [Accessed 21 Feb. 2017].

Hassenzahl, M. (2010). Experience Design: Technology for all the right reasons. *Synthesis Lectures on Human-Centered Informatics*, Morgan Claypool.

ISO 9241-210, (2010). Ergonomics of human-system interaction - Part 210: Human-centred design for interactive systems. International Standard.

Kaasinen, E., Roto, V., Hakulinen, J., Heimonen, T., Jokinen, J.P., Karvonen, H., Keskinen, T., Koskinen, H., Lu, Y. & Saariluoma, P. (2015). Defining user experience goals to guide the design of industrial systems. *Behaviour & Information Technology*, no. ahead-of-print, pp. 1-16.

Kaye, J. J. & Taylor, A. (2006). What does science know about experiences? Alternative approaches to evaluating user experience. NordiCHI 2006 Workshop: User Experience – Towards a unified view. Oslo, Norway.

Klocek, S. (2012) Fixing A Broken User Experience. [online] Stefan Klocek. Available at: <http://www.stefanklocek.com/fixing-a-broken-user-experience/>. [Accessed 24 Apr. 2017]

Kujala, S., Roto, V., Väänänen-Vainio- Mattila, K., Karapanos, E. & Sinnelä, A. (2011). UX Curve: A method for evaluating long-term user experience. *Interacting with Computers*, vol. 23, no. 5, pp. 473-483

Miettinen, Satu. (2017). *An Introduction to Industrial Service Design*. London; New York: Routledge, Taylor & Francis Group, 2017.

Mäkelä, M. (2017). Introducing design thinking to large, technology-oriented companies (pp. 91-96) *An Introduction to Industrial Service Design*. London; New York: Routledge, Taylor & Francis Group, 2017.

Flaherty, K. (2016). How Channels, Devices, and Touchpoints Impact the Customer Journey. Nielsen Norman Group. Available at: <https://www.nngroup.com/articles/channels-devices-touchpoints> [Accessed 24 Apr 2017]

Roto, V., Lu, Y., Nieminen, H. & Tatal, E. (2015). Designing for User and Brand Experience via Company-wide Experience Goals. *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems ACM*

Roto, V., Kim, T.Y., Markgren, H., Rebelo, C., Sundeson, K., Lindborg, I. (2015). *Trusted to Deliver Excellence – Trust Design in All Touchpoints*, Aalto University, Rolls-Royce Marine

Roto, V., Law, E., Vermeeren, A. & Hoonhout, J. (2011). User experience white paper: Bringing clarity to the concept of user experience. Available at: <http://www.allaboutux.org/files/UX-WhitePaper.pdf> [Accessed 24 Apr. 2017]

Roto, V., Nuutinen, M., Smedlund, A., Passera, S. (Eds.). (2012). *A Glimpse of UX for B2B industry – Issue 1. FIMECC UXUS*.

Sanders, E. & Dandavate, U. (1999). *Design for Experiencing: New Tools*. First International Conference on Design and Emotion, TU Delft.

Sundberg, H. (2015). "The Role of User Experience in a Business-to-Business Context". Tampereen teknillinen yliopisto. Tampere University of Technology. Publication; 1278,

Vermeeren, A.P.O.S., Law, E.L., Roto, V., Obrist, M., Hoonhout, J., Mattila, K. (2010). User Experience Evaluation Methods: Current State and Development Needs, *Proceedings: NordiCHI 2010, October 16–20, 2010, Reykjavik, Iceland*

Meyer, C. & Schwager, A. (2007). Understanding customer experience. *Harvard business review*, vol. 85, no. 2, pp. 116.

Rawson, A., Duncan, E. & Jones, C. (2013). The truth about customer experience. *Harvard business review*, vol. 91, no. 9, pp. 90-98.

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TOWARDS HARMONIOUS EXPERIENCES

A service design approach to evaluating and
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